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**MODEL**

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NOVEMBER 1992

# AIRPLANE

THE WORLD'S PREMIER R/C MODELING MAGAZINE

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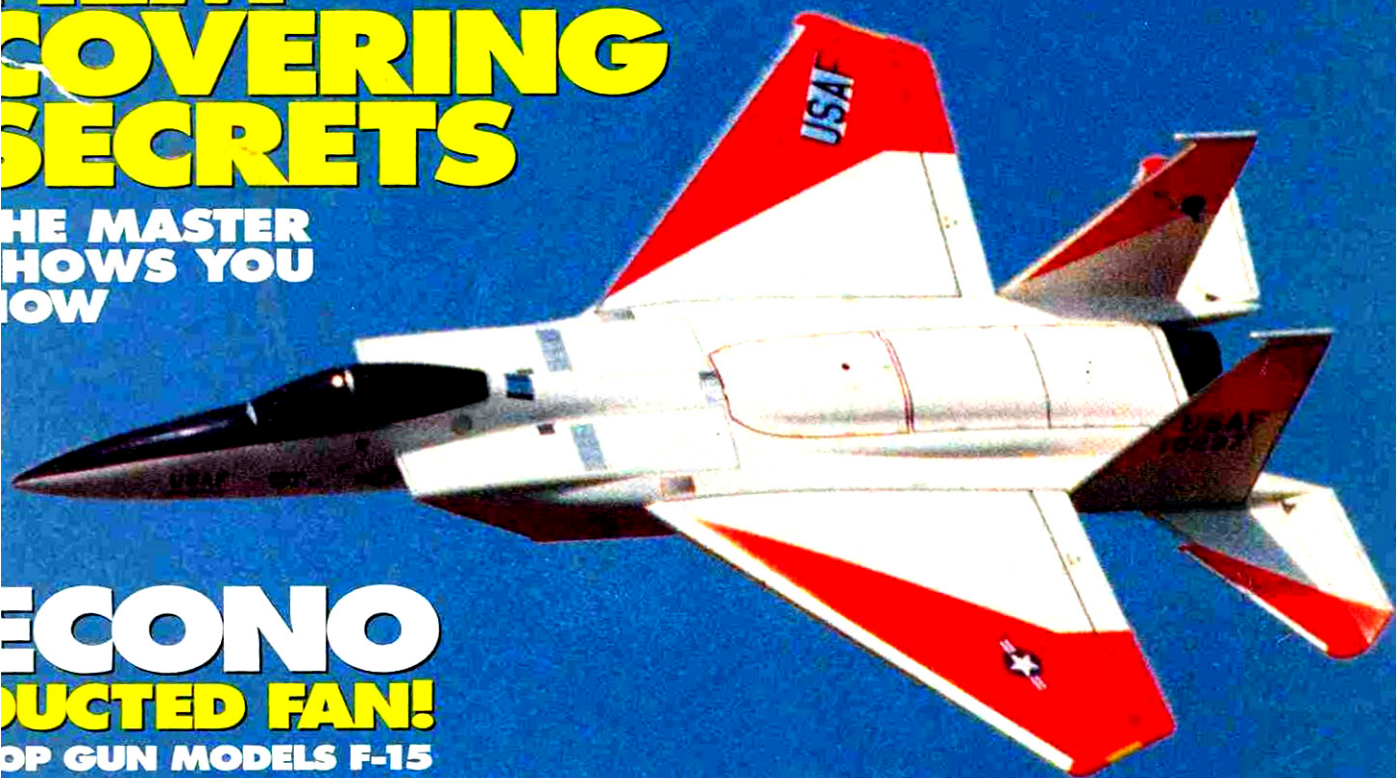
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**ABOVE:** Corsair alley at the 5th Annual Giant-Scale Warbirds Festival. (Photo by Gerry Yarrish.)

**ON THE COVER:** Top Gun Model's F-15 on a flyby under the summer skies of New Jersey. (Photo by Tom Atwood.) Inset: Group Commander Roy Vaillancourt and spotter concentrate on flying at the 5th Annual Giant-Scale Warbirds Festival. (Photo by Chris Chianelli.)

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# EDITORIAL

T O M   A T W O O D

## GIANT SCALE GETS BIGGER

We keep our ears to the ground so we can get a jump on developing trends in the industry, but sometimes no sleuthing is required. We find this to be the case with the steady growth in "giant-scale" modeling.

There are two major organizations that support giant scale modeling, the Quarter Scale Association of America (QSAA) and the International Miniature Aircraft Association (IMAA). To fly with the QSAA, your plane must be both scale and at least 1/4-scale in size. The IMAA accepts planes of at least 80-inch wingspan, but this includes sport planes as well as scale aircraft.

Both organizations dedicate their fly-ins to the fun of flying giant-scale models, not to competition. Although unlimited racing is another facet of the growth in large-scale modeling, its competitive nature distinguishes it from traditional giant-scale.

The IMAA held its 12th Annual Rally of the Giants on June 18 to 20 at the Richards Gebaur airport in Kansas City, MO. Correspondent Kirk Gullach, who

Kansas City area, were notified that Kansas City was the selected site for the 12th Annual IMAA Rally of the Giants, we instantly knew that our work was cut out for us. It would take the combined effort of both clubs to put on an



Site of the IMAA 12th Annual Rally of the Giants.

event of this magnitude.

"Pilots started calling to register in December, one month before the registration forms were printed. The strange part was, there was not a big rush to register. Only 200 pilots had registered by mid-May. Not nearly as many pilots nor manufacturers had registered as hoped. Then there was the last-minute fury.

Pilots were registering at such a rate we shut off pre-registration and told the pilots to register on site.

"A week before the rally, we knew we had a show. With 30 states represented, 437 registered pilots brought about 700 giant-scale aircraft. We were amazed. This exceeded our wildest expectations. We also filled 38 manufacturers' booths. I think this is testimony that a national rally is

both wanted and needed to bring pilots and planes together from around the country.

"On Tuesday and Wednesday before the June 18 starting date, the winds were very strong, so the large tents could not be set up until late Wednesday. Two giant tents were used for plane storage; the largest was 60x150 feet in size. There were also two large manu-

facturers' tents, as well as tents for registration/aircraft inspections, seminars, prizes and an impound.

"We used 1,000 feet of runway. The flight line started with five stations and soon went to six and then seven, and even an eighth was used at times, given the volume. I saw some of the best flying that I have ever seen. Two outstanding pilots were Frank Noll of Dayton, OH, and Harold Noirfalise of Joplin, MO. Both could do a roll so smooth and slow that it took the entire length of the field—and this about 15 feet off the ground. Of course, Bubba Spivey of Lanier R/C showed us what hot-dog flying was all about with his Stingers. (There was so much smoke from his plane, not a single insect was in sight.)

"One couldn't help but notice the wide variety of airplanes. These included warbirds, aerobatic, civilian, antiques, jets and fun-fly ships. The quality of some of these models was really astonishing.

"Every pilot received a grab bag. The sum total of these prizes came to over \$17,000. (Handling this many prizes was a full time job in itself.) Thanks to all who supported the pilots with their donations.

"Friday night, over 450 people enjoyed a Kansas city barbecue with country music and square dancing afterward. To sum it up, it was not the two clubs that made the greatest rally ever, but the pilots who attended. They brought with them the camaraderie, fellowship, good times and, of course, the entertainment."

Our thanks to Kirk for the report. Here are the addresses of the organizations mentioned: IMAA, Don E. Vinyard, Secretary, 205 South Hilldale Road, Salina, KS 67401; (913) 823-5569; QSAA, P.O. Box 13980, Las Vegas, NV 89112; (702) 293-0035.



was involved in coordinating this year's event, provided the following brief report on this year's Festival. His account shows that even the "insiders" in the planning of giant-scale events have been surprised by the level of interest now being shown.

"When the 114th Jayhawk Squadron and 49th Jumbo Squadron, both of the



# MODEL AIRPLANE NEWS

THE WORLD'S PREMIER R/C MODELING MAGAZINE

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**Publisher** DR. LOUIS V. DeFRANCESCO

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**SUBSCRIPTION INQUIRIES:** call 1-800-827-0323.

**MODEL AIRPLANE NEWS** (ISSN No. 0026-7295) is published monthly by Air Age, Inc., 251 Danbury Rd., Wilton, CT 06897. Connecticut. Editorial and Business Offices, 251 Danbury Rd., Wilton, CT 06897. Phone: 203-634-2900. FAX: 203-762-9803. Y.P. Johnson, President; G.E. DeFrancisco, Vice President; L.V. DeFrancisco, Secretary; Yvonne M. DeFrancisco, Treasurer. Second Class Postage Permit paid at Wilton, Connecticut, and additional Mailing Offices. Copyright 1992 by Air Age, Inc. All rights reserved.

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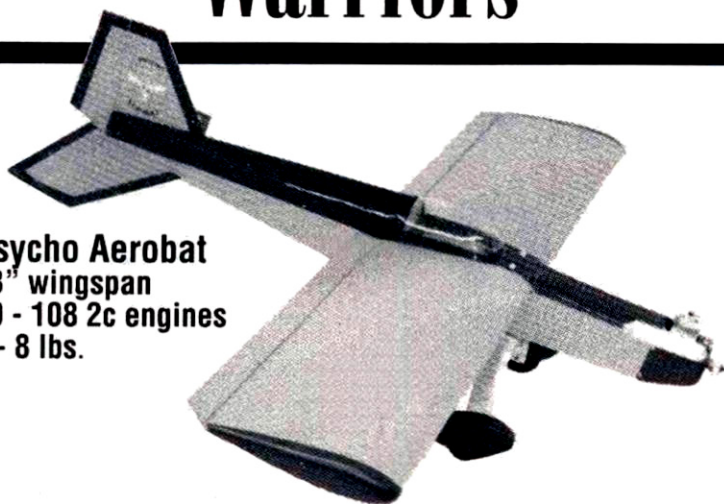
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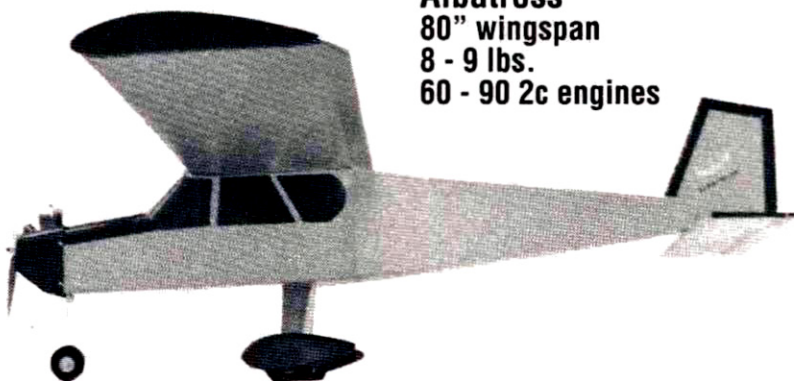
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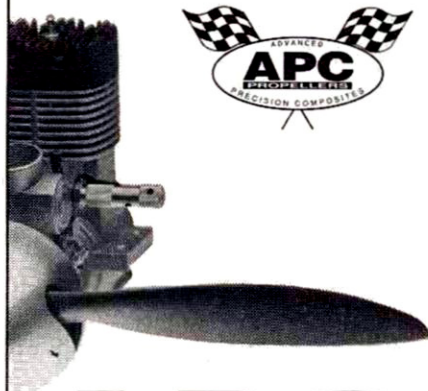
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# AIRWAVES

WRITE TO US! We welcome your comments and suggestions. Letters should be addressed to "Airwaves," Model Airplane News, 251 Danbury Road, Wilton, CT 06897. Letters may be edited for clarity and brevity. We regret that, owing to the tremendous numbers of letters we receive, we cannot respond to every one.



## ANDY RESPONDS

I read Andy Lennon's article—"Wing-Loading Design"—in the August issue with some surprise. I confess, I usually scan his stuff because it's usually more technical than suits my style of flying and modeling, but his comments on wing loading caused me to take more time for this one.

Is he trying to make sure we're all awake and paying attention? Why else would he say that he favors "higher wing loadings because they result in smaller, stronger, faster and—if you're careful in the design and construction phases—less 'draggy' aircraft"?

Making a plane heavier (higher wing loading) won't magically shrink it. Maybe he means that if you build heavy, you get a smaller airplane for a fixed weight—but why?

Making a plane heavier won't make it go faster. Yes, you'll have to fly it faster to develop the lift necessary, all other factors being equal, but you'll also have higher induced drag. Your top speed will be lower. Talk to any racer about that one, from 1/2A to unlimited. Lighter is better—and faster.

Making a plane heavier will only result in lower drag if it's designed and built intelligently. If, by investing some weight in a cantilever wing, you can get rid of the "draggy" struts, flying and landing wires, then that's weight used wisely. Too often, weight added is for a controlled crash/landing. You don't need a massive landing gear to fly—but you might need it to land a "lead sled."

In-flight loads rise with speed and weight. The heavy model will accelerate, turn and climb more slowly, and it will take up more sky to do maneuvers because of its increased speed and momentum. It will recover from stalls more slowly, as well as have longer takeoff and landing runs. It will have a higher landing speed and so "arrive" with greater force.

I think that Andy's concern with his Swift wing having to withstand a force of

73.75 pounds in a fast 50-foot radius turn is misplaced. He likes "stiff, strong, fully sheeted and stress skinned structures." I think he'd have to yank the Swift wing harder than 73.75 pounds to break it. Again, talk to Formula One racers about (a) tight, hard banked turns and (b) structural weight and strength.

Andy makes one point with which I have to agree: heavier wing loadings cause you to fly closer to stall, so it's easier to enter snap maneuvers. (Hey, that's just what I look for when I take a new plane out for a test flight, don't you?)

Andy has always liked the more aerodynamically advanced approach, but I have to question his conclusions this time.

MARTIN IRVINE

Kingston, Ontario, Canada

*Martin, your letter takes one paragraph out of context, however, your problem in understanding it may be shared by many others. Hopefully the following will provide a better understanding.*

*The basis for my statement on higher wing loadings is to be found in current, full-scale, home-built aircraft, such as Glassairs, Langairs and Ventures. These sleek, high-performance aircraft all use high-lift devices to help to achieve outstanding performance on relatively modest horsepower.*

*Long ago, their designers realized that with low wing loadings, the resulting large wing areas required for reasonable, safe takeoff and landing speeds were much bigger than was necessary at the much higher speeds of cruising and maneuvering flight. Larger wings mean bigger, heavier airplanes—with more drag, more horsepower, more fuel and so on.*

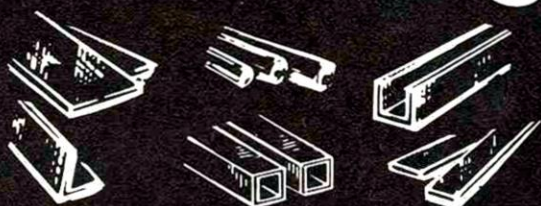
*This has led to smaller, more heavily loaded airplanes. To provide safe takeoff and landing speeds, the smaller wings incorporate high-lift flaps, principally the slotted variety. Extended, these almost double the wing's lift co-efficient and their drag slows these sleek airplanes. Partial extension results in slower and shorter takeoff runs.*

*The smaller overall size drastically reduces their drag and, together with careful attention to other drag sources, ac-*

(Continued on page 10)



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237	.025 x 1	.90
238	.025 x 3/4	.65
239	.025 x 2	1.70
240	.032 x 1/4	.35
241	.032 x 1/2	.55
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## AIRWAVES

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The Swift's outstanding performance proves my point. It has flown with two sizes of APC prop—10x9 (static rpm 12,000) and 10x10 (static rpm 11,000). It has been piloted by five fellow club members who have enjoyed its excellent behavior.

The Swift's top speed is 100mph. Takeoffs with flaps half extended require under 15 feet of ground run. Touchdown speed, flaps fully extended, is in the low 20s. Stall occurs at 18mph. It has an unusually wide speed range—and is not a "lead-sled". Its vertical performance is superb; it does vertical 8s with ease and grace. Penetration is excellent; lowering the flaps doesn't affect longitudinal trim, the model just flies much slower. It's highly maneuverable, yet stable.

Thanks to the NASA droop, aileron control in the stall is effective, but the Swift refuses to do more than one or two turns of a spin, converting to a fast spiral dive instead. The stressed-skin structure absorbs the high "G" maneuvering loads with ease. Its total weight of 92 ounces (fueled) compares very favorably with 40-size kit models now available.

By your own admission, you "scan" my articles. Had you given them more consideration, you might not have had this misunderstanding. I hope this clarifies things for you.

AGL

(Continued on page 114)



# AIR SCOOP

CHRIS CHIANELLI



*New products or people behind the scenes—my sources have been put on alert to get the scoop! In this column, you'll find new things that will, at times, cause consternation, and telepathic insults will probably be launched in my general direction! But who cares?—it's you, the reader, who matters most! I spy for those who fly!*

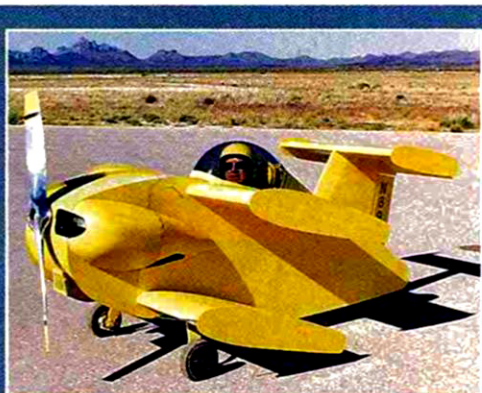


## One-Armed Ace



For those who have low blood sugar and who simply must eat and fly at the same time, inventor Roger Kaye of Fort Ann, NY, has developed what he calls his "intuitive" controller/transmitter. The stick moves in three axes for pitch, roll and yaw control and has a trigger and

two thumb-buttons for the throttle and auxiliary channels. While the advantages, both civilian and military, of having one hand free are obvious, Roger also reports that three non-fliers took-off, flew and landed successfully their first time out. Roger attributes this to the "organic connection" the brain makes with this unit. Roger's patented design is being considered for production by a major radio concern. Watch "Airscoop" for updates.



## BUILD A MODEL OF A GUINNESS WORLD RECORD-HOLDER

Pilot/designer Robert H. Starr is offering 1 inch=1 foot, exact-scale plans for a static model of his Bumble Bee II, which holds the Guinness World Record for the smallest piloted airplane. The full-scale Bumble Bee II was 8 feet, 10 inches long with a 5-foot, 6-inch wingspan. (You could simply enlarge the plans, which sell for \$19.95, to make a full-scale R/C version of the Bumble Bee II.) Robert also supplies autographed pictures and other information. He has logged an astounding 15,000 hours of stick-time, which includes serving in a Curtiss P-40 in China with the 311th Fighter Group, 530th Fighter Squadron as a Flying Tiger! For more information, contact Bumble Bee Enterprises, 938 East Concorda Dr., Tempe, Arizona 85282; (602) 967-0361.

Ever want to run a stop sign? Well now, thanks to Custom Air Products, you can fly one! The 30-inch, pre-sheeted flying Stop Sign comes with a complete hardware package. The manufacturer states that the Stop Sign can be flown by any pilot who has mastered an advanced trainer, and that helicopter-like vertical landings are possible in 10 to 15mph breezes. Its flying weight is 4 to 4½ pounds with a recommended powerplant of a .35 to .40 2-stroke engine.



The complete kit is \$49.95 (plus shipping). So, if you want to be the "constable of the clouds" at your field, contact Custom Air Products, 16931 56th Ave., Coopersville, MI 49404; (616) 837-6751.



## MITCHELL BY WING

Wing Mfg. will soon offer a Pro Series short kit of the much-loved North American B-25. Designed by scale modeling expert Hal Parenti, the B-25 features all-balsa construction with foam-

cores for the wing and stab. Specs: wingspan—82 inches; wing area—920 square inches; weight—12 to 15 pounds; recommended engine size—.48 to .90 4-stroke or .40 to .60 2-stroke. The kit will include three sets of plans; foam-core wing

and stab; all necessary vacu-formed plastic parts; die-cut bulkheads, formers and firewalls; and a custom hardware package. For more information, contact: Wing Mfg., 306 E. Simmons, Galesburg, IL 61401; (309) 342-3009.



# AIR SCOOP

## Agri-Copter

In the September '91 installment of "Airscoop," I highlighted the Yamaha/Hirobo R-50 crop duster in a piece called "R/C Bug Assassin." Thanks to my new contact in Japan, Senji Watanabe, new information about R/C pest



control in Japan has come to light. These photos of the "Sky Robot" manufactured by Kobe Giken Co., were recently taken during tests at the Himeji Golf Country club near Osaka. The crop-dusting Sky Robot has a 10-foot-long fiberglass fuselage and weighs 130 pounds. It's powered by a recoil-started, air-cooled 8.7ci opposed twin-ignition engine. Its main rotor is 11 feet long and payload is up to 55 pounds. Insecticide is probably fed to the machine by an ultra-thin tube, such as the one that the R-50 uses. Watanabe-san will receive a one-year subscription for supplying me with this info.



## ZIROLI PANTHER

Here's R/C's cheerful, "design legend" Nick Zirola (he can also be cranky) at the 5th Annual Giant-Scale Warbirds Festival in Wilmington, DE, with his new IMAA-legal Grumman F9F Panther. I saw the Panther fly many times at this meet, and all I can say is: very, very impressive. This 72-inch-span Panther not only tracks like a pattern ship at 120mph, but it turns into a kitten with flaps at landing speeds. The highly detailed plans come in three sheets—more than 54 square feet! Nick can supply fiberglass inlet ducts, engine covers, a vacu-formed canopy, tip-tanks and a nose cone. Ready-to-mount retract assemblies that will include struts and wheels will be available very soon. And what's the best part of this very accurate Zirola scale success? No cheater holes. For more info, contact Nick Zirola Plans, 29 Edgar Dr., Smithtown, NY 11787, or give Nick a call (don't worry he's cheerful 99 percent of the time) at (516) 234-5038.



Flash! The Aeroplane Works (2134 Gilbride Rd., Martinsville, NJ 08836; [908] 356-8557) offers many of the Zirola designs in full kit form. The Panther will soon be on their list. Get in touch with them; their kit cutting is reported to be superb.

## Japanese Cub

Scale-model trophy winner and author Bud Voss has been flying R/C airplanes since 1948, and many of his scale models reside in museums throughout Japan. His first successful R/C plane was a DeBolt Live Wire that used a hard-tube receiver, a 67.5V plate battery and a Babcock Mk2 compound escapement. When he isn't busy with scale-modeling, Bud spends time on his other hobby: restoring and flying full-scale aircraft at Yokota AFB on the outskirts of Tokyo. He owns and operates the only airworthy



Piper J3C-65 Cub in Japan! This particular Cub rolled off the Lockhaven, PA, assembly line on September 20, 1946, with the serial number 20069 and the U.S. registry number NC6844H. It was found in pieces in a shed in northern Tokyo, where it had been since 1973. It was one of three Cubs that had been operated in Okinawa by the U.S. Air Force Kadena Aero Club from 1950 to 1973, when Okinawa was still under U.S. administration.



Top Flite believes it has created the most accurate sport-scale P-51D yet with the "Gold Edition" Mustang, which features an exact-scale outline. With its many vacu-formed parts, e.g., a radiator scoop and wing guns, and its computer-designed interlocking construction, the easy-to-build P-51D has a high degree of authenticity and is an excellent first scale project. The Gold Edition Mustang has a 65-inch wingspan, a wing area of 734 square inches, and it requires a .60 to .91 2-stroke or a .90 to 1.20 4-stroke engine.

## SCALE OFFERINGS



Great Planes has re-created Dean Hull's crowd-pleasing Super Skybolt in 1/5-scale. The kit, which features all-balsa construction with many ABS vacu-formed parts, has built-in wing tabs that eliminate the need for a building jig and interlocking parts that automatically hold the cabane struts at the correct angle for a nearly effortless installation. Specs: span—57 inches; area—930 square inches; weight—8 to 9.5 pounds; recommended power—.60 to .90 2-stroke or .90 to 1.20 4-stroke.



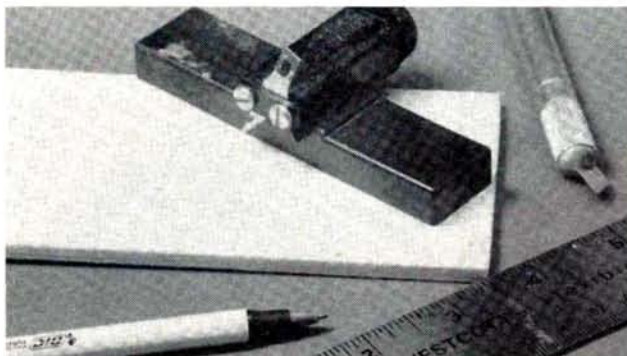
# How To:



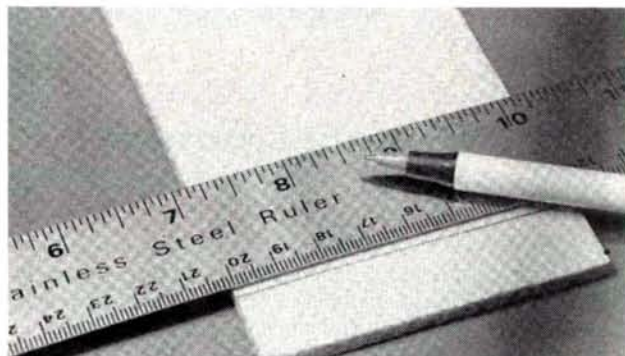
R A N D Y   R A N D O L P H

## MATCHED LONGERONS AND SPARS

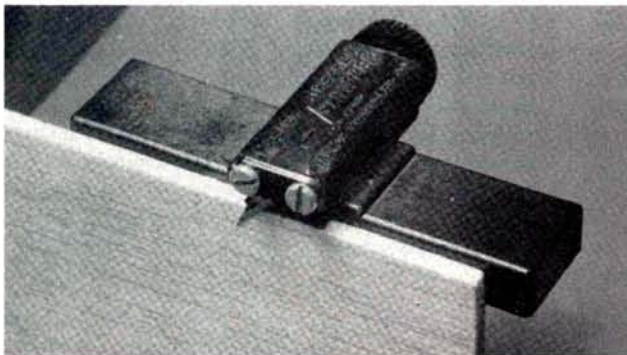
*One of the principal reasons why a fuselage might become twisted, bowed, or otherwise distorted is that it has unmatched longerons. The weight and strength of randomly selected balsa spars rarely match, and this leads to mismatched wing panels. The photos show a way to ensure that balsa strips match one another and are suitable for the job that they must perform in the finished airplane.*



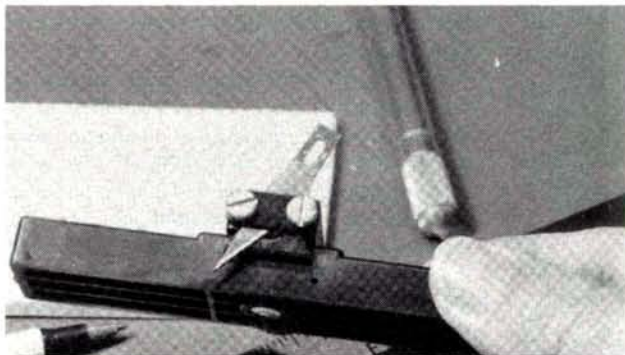
**1.** Strip spars and strips out of the same balsa sheet. You'll need a stripper, a straightedge and a felt-tipped pen. In a pinch, you can use a straightedge and a modeling knife, but the stripper is infinitely better.



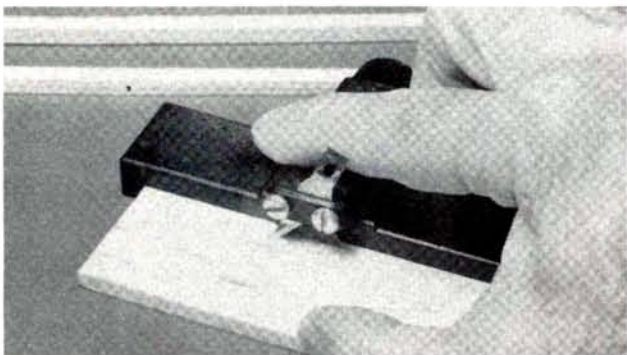
**2.** Using a straightedge, draw a line across the balsa sheet about 1 inch from one end. This will allow you to match the sides and grain of each strip.



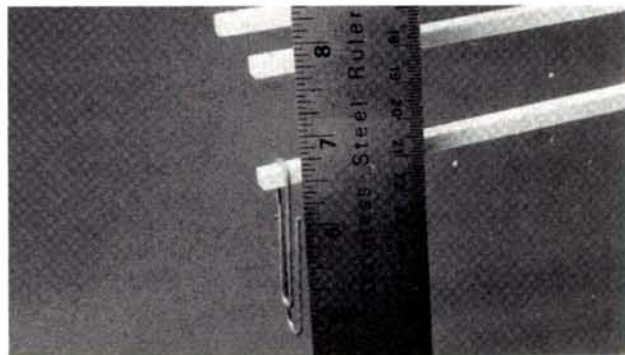
**3.** To set the stripper for square stock, adjust the blade to the width of the sheet. Because of manufacturing tolerances and climatic conditions, the width of sheet balsa can vary from sheet to sheet.



**4.** If you try to cut all the way through thick stock, the blade won't cut the wood in a straight line; it will bend and produce an uneven strip. For a "truer" strip, cut only a little more than halfway through the stock.



**5.** To complete the slice, turn the sheet over and complete the cuts that you just made. Hold the stripper firmly against the side of the sheet and slice smoothly and evenly.



**6.** Align the finished strips with the mark you drew on the sheet. Anchor the strips about 6 inches from the marked end so that they extend horizontally a few inches above the workbench. Use a small weight on the end of each strip (in this case, a large paperclip) and measure the flex of each strip. Match those that are the same.



## ENGINE REVIEW

by MIKE BILLINTON

### Useable power in a unique package

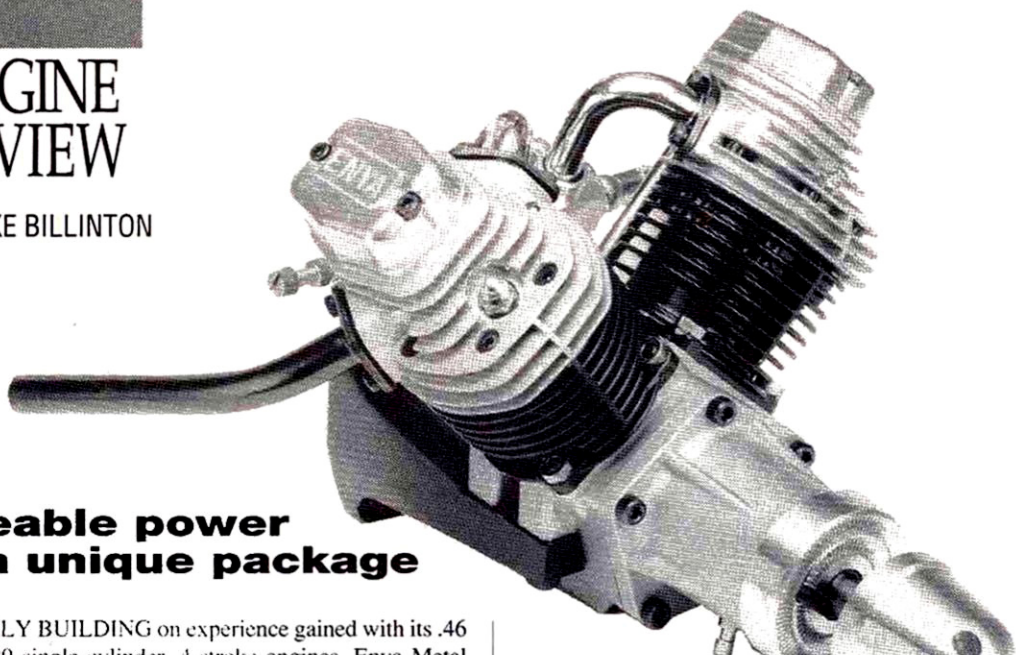
SENSIBLY BUILDING on experience gained with its .46 and R120 single-cylinder, 4-stroke engines, Enya Metal Products has moved with some confidence into the multi-cylinder market with this 80-degree V-Twin.

My first vivid impression of this V-Twin was of its admirable compactness allied to a purposefully robust and refined construction; and first dynamic impressions on the dynamometer were very much in keeping with the initial impressions, with instant starts and smooth running immediately apparent.

This 2.4ci twin lies approximately midway between its forerunners, the 1.6hp, 1.2ci single and the 2.1hp, R1.2ci single—probably a result of combining, in principle, the longer valve opening (and breathing) periods of the R120's cam design with the lesser breathing capacity of the less-powerful 120's smaller valve throughways. Enya appears to have used standard 120 cylinder heads with vertical valves (the R120 has inclined valves allowing more effective breathing) and the compression ratio at which these heads have been fitted to this twin is a very low 6.7:1. This suggests a recognition that this engine will be attached to large, heavy propellers that have considerable inertia and operate at modest rpm near to maximum torque points. If this is the case, a relative retarding of ignition point could be called for, compared to 120 single-cylinder engines, which, of course operate on much smaller, lighter propellers. This retardation is best achieved in the "fixed-point" glow-plug engine by reducing the compression ratio, and an implication of all this is that the use of variable-point spark ignitions (and, therefore, an allowable increase of compression ratio) would raise the power levels of this twin significantly.

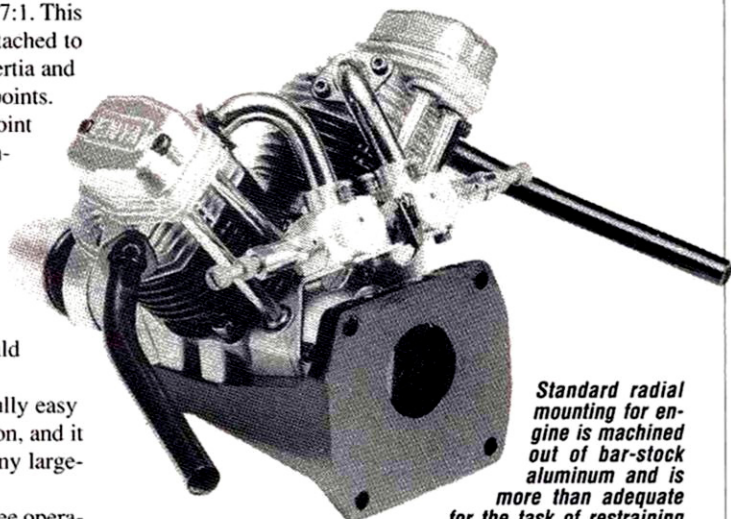
As supplied though, the 240 Twin is delightfully easy to manage and, not surprisingly, free of detonation, and it clearly produces enough power to cope with many large-scale projects.

In comparison with the exemplary vibration-free opera-



*A well-knurled prop driver gave continual good propeller security.*

tion of a flat-twin, the V-Twin offers only slightly inferior balancing—though both these layouts are superior in this aspect when compared with the inclining of cylinders yet closer together in front view to the point where they become in-line. In this event, of course, one cylinder must be staggered behind the other, so increasing overall length and overhang of the engine, plus resultant crankshaft complication and some reduction of air cooling to the rear cylinder. This V-Twin does allow room for an optimal method of mounting the engine on traditional wooden bearers that extend back into the fuselage nose.



*Standard radial mounting for engine is machined out of bar-stock aluminum and is more than adequate for the task of restraining this 40cc powerhouse.*



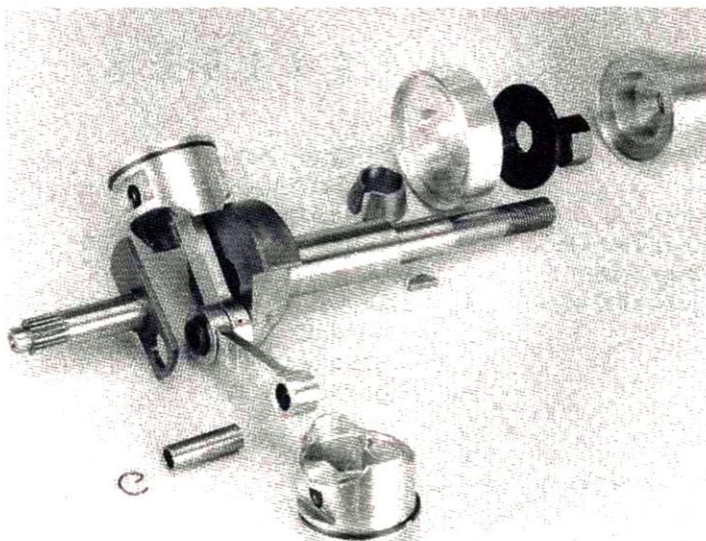
## MECHANICAL POINTS

A finely produced, aluminum-alloy, die-cast crankcase is machined to support a detachable front housing, the two cylinders and, at the rear, a ball-race-mounted timing gear driven off crankpin extension. This pinion then drives the two phosphor-bronze-supported half-speed cam pinions—the upper actuates the inlet valves of both cylinders and the lower operates the exhaust valves. Four studs and nuts secure each aluminum cylinder (with their inserted, hardened-steel cylinder liners) on the upper machined faces of the crankcase block.

Shallow aluminum pistons—with single, cast-iron rings—are used, having large cut-aways to clear crankweb. Wire circlips secure the floating wristpins within the piston. The aluminum-alloy front housing is attached to the crankcase with five Allen-head bolts, and two ball bearings support the simple, hardened-steel crankshaft. This engine has sufficiently small offset between the two cylinders (in plan view) to allow both slim connecting-rod big-end bearings to lie on the one fairly short crankpin—the rear end of which protrudes just enough to drive the timing pinion web. Propeller-driver security is well-thought-out—using standard tapered collet that's fixed with a woodruff key to the shaft, and two coned spring washers ensure propeller nut does not loosen easily in the event of punchy 4-stroke backfiring or detonation (none occurred, however.) If required, two threaded pins can be fitted to the prop driver front face to further secure the propellers against accidental rotation, but these weren't used in this test because I feel that they can weaken the wooden prop hubs. Positive, firm tightening of the prop nut prevented any propeller-loosening problems throughout testing.

In familiar Enya style, all valve operation is at the rear of engine, endowing the V-twin with a clean, uncluttered front end that fits well into aircraft designs. Overhead valve operation is by way of pushrods and cast-steel rockers that operate at a 1.5:1 ratio advantage, which leads to a final valve lift of about 3.35mm. Valve throughway diameter is 10mm compared with the 13mm inlets of the R120 engine. Aluminum alloy cylinder heads are held to the top face of the aluminum cylinders by six Allen-head bolts. Both the valve seat and the guide are machined out of a single piece of bronze phosphorous, and induction and exhaust tubes are of the flanged, bolt-on type. The induction tracts are aligned to allow simultaneous, identical operation of the two standard 7.5mm-bore G7 Enya carburetors. These units feature the very simple air-bleed idling control and main fuel needle only, i.e., no adjustable mid-range mixture control, though the carbs' design ensures an automatic slightly rich mixture in this area.

The use of more sophisticated carburetors with more adjustable



*A very short piston is used with cutaways to clear crank web. Pistons are machined out of bar-stock aluminum. Note keyed, tapered collet for the prop driver.*

controls would probably have caused problems in matching cylinder response for most users, including me. As it turned out, attaining nominally equal cylinder output at varied throttle openings proved quick and easy.

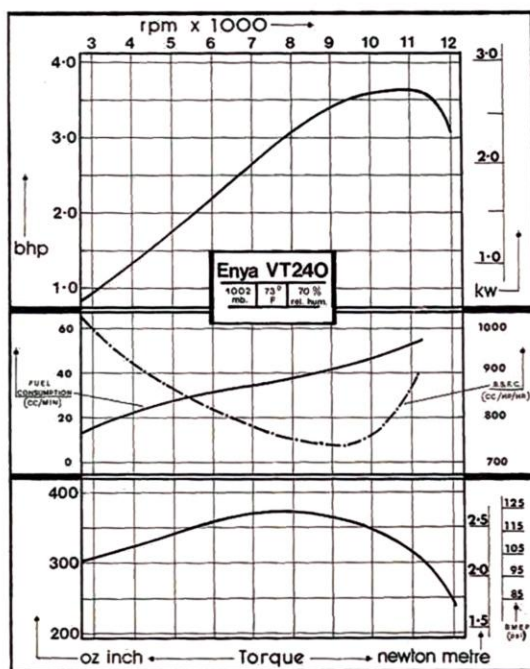
No muffler is supplied, but an optional "special" muffler with a 29cm flexible extension is available. Tested without the muffler, the sound output was quite crisp, but not unduly so for such a large-capacity engine. This was, no doubt, because it has relatively low rpm levels and a fairly low compression ratio, and it's a 4-stroke.

A very sturdy radial/beam mount is supplied, and was used during this test to attach the engine to the dynamometer.

## RPM AND POWER TESTS

Open exhaust. Enya no. 3 glow plugs. Fuel: 10 percent nitromethane, 15 percent castor. A variety of propellers was used, ranging in achieved rpm from 3,600 to 10,600. As stated by the manufacturer, steadiness of running and actual rpm did improve slightly during the first half an hour of operation, and the rpm figures shown are those measured toward the end of that period of running-in.

Enya's horsepower claim is 3.2 at 10,500rpm, a practical rpm range from 6,000 to 11,000, with an eventual "critical" speed at 11,500rpm. As can be seen on the test graph at least, the claim appears to be quite conservative because a substantial output of 3.62hp (after atmospheric correction) was attained at 11,100rpm.



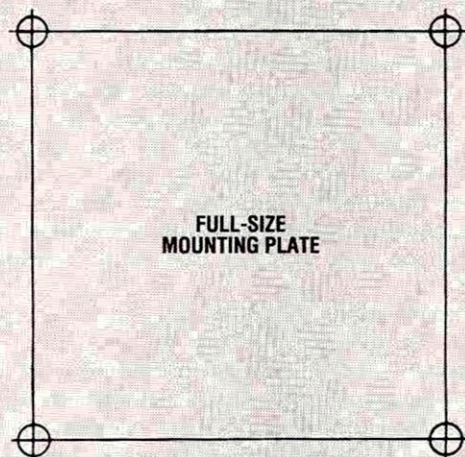


## SPECIFICATIONS

### WEIGHTS & DIMENSIONS

Capacity	2.4488ci (40.129cc)
Bore	1.222 inch (2.04mm)
Stroke	1.044 inch (26.51mm)
Stroke/bore ratio	0.854:1
Timing periods	Inlet opens-27° BTDC
(with 0.002 inch valve lash)	Inlet closes-75° ABDC
	—Total 282°
	Exhaust opens-67° BBDC
	Exhaust closes-37° ATDC
	—Total 284°
	—Overlap-64°
Combustion volume	3.5cc (1 cyl.)
Compression ratio	Geometric-6.73:1
Squish clearance	0.065 inch
Squish area	0.15 sq. inch (13% of piston area)
Squish angle	0°
Carburetor bore	0.414 inch (10.54mm)
Crankshaft diameter	0.6687 inch (17mm)
Crankpin diameter	0.3930 inch (10mm)
Wristpin diameter	0.275 inch (7mm nominal)
Crankshaft nose thread	0.370 x 24 TPI (3/8 unf.)
Wristpin diameter	0.236 inch (6mm)
Connecting-rod centers	42mm
Engine height	4.8 inch (122.3mm)
Width	6.3 inch (160mm) (across heads.)
Length	5.12 inch (130mm) (backplate to prop driver)
Width between bearers	1.76 inch (44.7mm)
Mounting-hole dimensions	radial—4 off 2.126 inch sq. spacing. (54mm)
	beam—0.78x2.34 inch (20x59.5mm)
Frontal area	15.45 square inches
Overall weight	3.75 lbs. (1.7 kilo.)
Crankshaft weight	6.1 ounce (173 gms)
Piston weight	0.55 ounce (15.6 gms)
Performance:	
Max. b.hp	3.62 @ 11,100rpm (open exhaust/10% nitro)
Max. torque	372 ounce/inches @ 7,800rpm (open exhaust/10% nitro)

Manufacturer: Enya Metal Products Co. Ltd., Tokyo, Japan U.S. Distributor: Altech



FULL-SIZE  
MOUNTING PLATE

### RPM on standard fixed-wing propellers:

(Open exhaust/10% nitro)	
24x12 Punctilio Airflow	3,610
24x10 Punctilio Airflow	3,910
24x8 Punctilio Airflow	4,200
22x10 Merati	4,320
24x8 Zinger	5,300
22x8 Mastro	5,430
20x8 Mastro	5,980
20x10 Kavan	7,050
18x7 Mastro	7,700
18x8 Topflite	8,000
20x6 Zinger	8,020
15x8 Graupner nylon	10,600

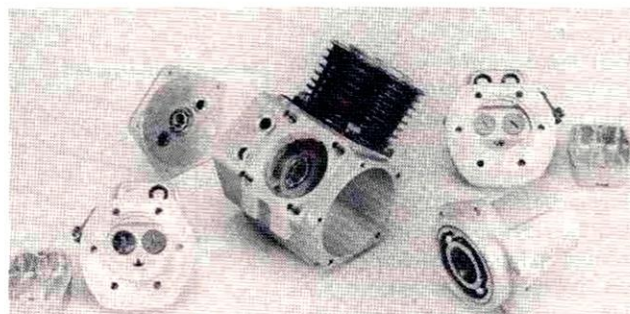
### Performance Equivalents:

b.hp/cubic inch	1.48
b.hp/cc	0.09
Ounce inch/cubic inch	152
Ounce inch/cc	9.27
Gram meter/cc	6.6
b.hp/pound	0.965
b.hp/kilo	2.13
b.hp/square-inch frontal area	0.234

The manufacturer's "critical" point of 11,500rpm was almost exact, because torque dropped steeply from that point onward. Valve float was not in evidence (as a possible explanation) so this marked fall-off would appear to be due to severely reducing breathing capacity in that rpm area—maybe the result of a fairly late opening of the inlet valve. This late timing is well suited to low/medium rpm ranges. Another possible, though strangely variable, factor is the role of the fixed-point ignition represented by the glow plug. However, combustion sounded clean at all rpm, and applying battery current to the glow plugs while the engine operated at the high rpm/low torque—which can serve to ad-

vance ignition point—had no effect.

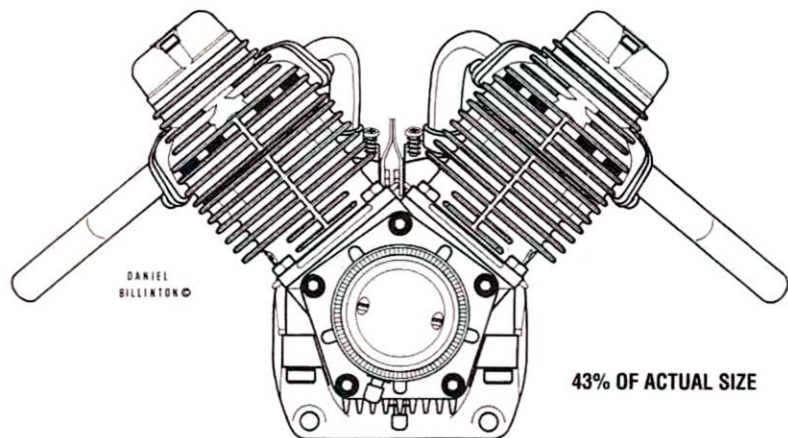
Just as noteworthy as the higher-than-claimed horsepower was that torque production itself was at a significantly high level, even down in the 3,000rpm area, i.e., well below the manufacturer's claimed speed range, so in practice, this allows the use of quite large, heavy propellers. Similar to test findings on the exemplary R120 single-cylinder engine,



Five-sided combustion chambers are used—with some surrounding squish area.

there appeared to be no signs that operation at such low rpm/full throttle/heavy





loadings caused undue mechanical stress to the engine, possibly pointing again to the advantageous side of the low compression ratio of 6.7:1.

#### FUEL CONSUMPTION AND SFC

This was another performance area where Enya's claims (60cc/minute) appeared quite conservative. Actual figures of this test increased almost linearly with rpm from just below 20cc/min. at 3,000rpm to 53cc/min. at 11,300rpm—at all points fairly achieved by using the manufacturer-recommended slightly rich fuel settings. It's possible that Enya intends to ensure that operators have a sufficiently generous fuel tank on board in the event that quite rich settings are used—which the manufacturer doesn't specifically discourage. Relative fuel efficiency proved markedly good considering the low compression ratio. (Within limits, the higher the compression ratio, the better the efficiency, with 15:1 being quite usual for marathon fuel-efficiency events.) For an engine with a less precise glow-plug ignition, running on methanol, at that low compression ratio, the best figure of 736 SFC units was really very credible. Model engines tuned for marathon events can reach down to 300 SFC units only by us-

ing the more fuel-efficient combination of spark ignition and high compression ratios.

#### IDLING PERFORMANCE

This was checked only on the fiberglass Kavan 20x10 which, in inertia terms, is around the midpoint of the various other propellers used. Rpm of 1,500 were easily achieved, and Enya suggests a reasonable idling speed of 1,800 to 2,000 rpm.

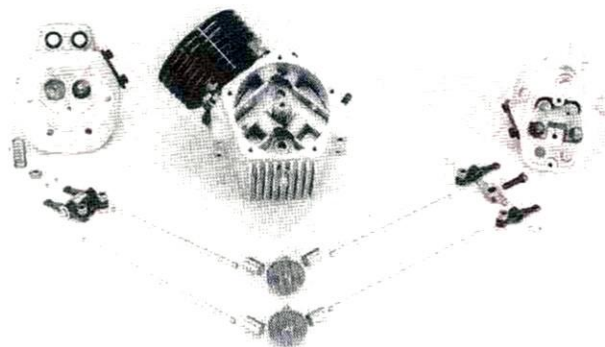
#### EQUALIZING CARBURETOR SETTINGS

The manufacturer's suggestion to check each cylinder's exhaust output for correct idling mixture worked well—the idea being to look for a halfway point between "too clean" and "too smoky" an exhaust. However, this method isn't practical for full-throttle/maximum-rpm settings because the massively increased air stream then easily eliminates the evidence.

Once break-in had been reasonably well-advanced, the method used during this test was (after opening both main fuel needles an equal amount—three turns) to reduce or lean-out fuel flow to one cylinder reasonably quickly until the first signs of engine rpm decline appeared and then, as swiftly as possible, open that needle ap-

proximately half a turn, i.e., to the desired, slightly rich position. Then repeat this procedure on the other cylinder/carb. This method should ensure that neither cylinder is running lean, but to further confirm the point, inspect the glow plug after a swift shut down from full

(Continued on page 54)



The upper cam wheel drives both inlet valves; the lower one drives the exhausts.

## FLIGHT INSTRUCTORS NEEDED



The AirCore 40 Family Trainer

Dear Fellow Modeler:

If you are an experienced modeler, no doubt you remember your first days in the hobby. Chances are, some nice modeler reached out and lent you a hand, offering advice, guidance and a little moral support. Isn't it time you returned the favor?

**GIVE THE GIFT OF FLIGHT** - This year, why not bring someone new into the hobby, or be that special friend. Many people want to learn our hobby, but they need a little encouragement and someone like you to answer questions and get them started. If you invest a little time, and give back to the hobby some of what it has given to you, you will be rewarded many times over for your effort.



The Barnstormer 40 "Bullet Proof" Biplane

Our mission at U.S. AirCore is to help people learn to fly, and supply them with rugged planes that survive their learning experience. (We even offer a crash-guarantee\* on the AirCore 40 Family Trainer.) Regardless of your airplane preference, we hope you share our belief that there are few hobbies offering the friendship, enjoyment or education that modeling has to offer.

*George Barker* *Lawrence Ragan*  
George Barker Lawrence Ragan

**U.S. AirCore**  
Model Aircraft Manufacturing

4576 Claire Chennault, Hangar 7  
Dallas, TX 75248  
214-250-1914

\*Call or send for details of the crash guarantee. See your local hobby dealer for AirCore kits. New VHS Video Catalog available for \$7.00 plus \$3.00 shipping



# CENTER ON LIFT

MICHAEL LACHOWSKI



## TRANSMITTER TOSS TO TRIM DRAG

THIS MONTH, I will touch on recommendations for color trim for your sailplane, use of wide glass cloth, a new event called "transmitter toss," and finally, a fairly technical subject—sailplane "trim drag" and the related question of selection of the optimal CG. Getting the right trim setup on your model sailplane will make it easier to fly. Correct aerodynamic trim reduces the need for control input and optimizes model efficiency by reducing drag.

Add to this the right trim colors and you will have improved visibility and ability to fly smoothly at a distance.

### TRIM FOR VISIBILITY

Visibility can be improved by selecting the proper trim scheme and colors. I recommend two approaches which, in combination, are very effective. Trim colors can be applied on the wing, tail, and fuselage. I apply strips along the wing and fin leading edges, and several stripes on the fuselage tail boom.

I like to apply chrome MonoKote trim along the leading edge of the wing and tail. This trim is good for sunny days, but isn't as effective in overcast or haze. Circling in a thermal far downwind, the sun reflects off the trim and improves the visibility of your plane. Note, however, that chrome trim will show any defects in your shaping of the leading edge. Mistakes such as flat spots really stand out.

My second choice for trim is fluorescent colors. I find that orange and red do a good job of improving visibility on bright or overcast days. The trim colors can be applied in the same areas as the chrome. I have found that alternating between chrome and fluorescent colors yields the best results on large wings.

Here are a few more techniques other modelers have used:

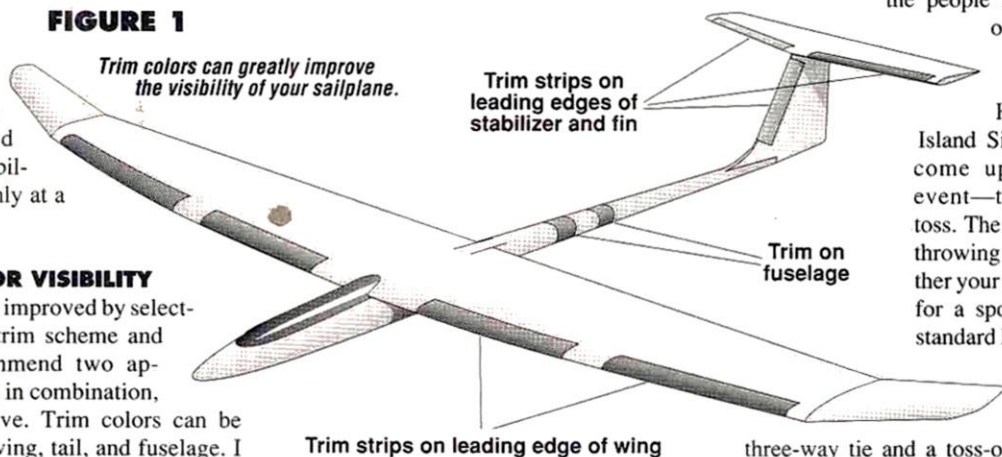
- Finish the aileron and flaps in a fluorescent color. The band of color on the trailing

edge can be seen at quite a distance.

- Use a different color on each half of the stabilizer. Finishing one stabilizer in a dark color and the other in a light fluorescent color provides a distinctive mark on your model.
- Use a dark color on the bottom of the wing to improve silhouetting.
- Use a bright band of color near the wing tip on white wings to define the wing tips.

FIGURE 1

Trim colors can greatly improve the visibility of your sailplane.



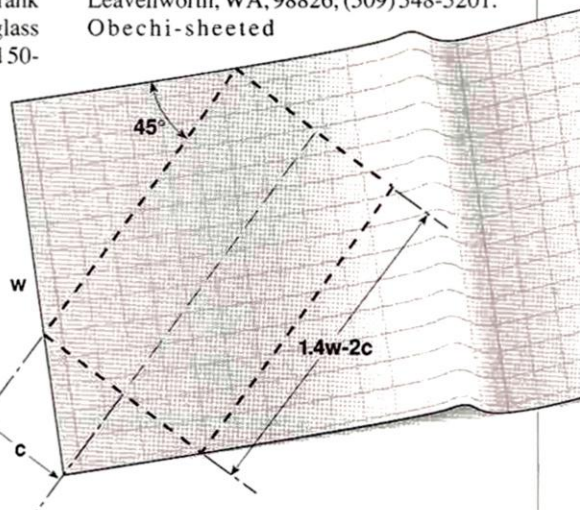
Trim strips on leading edge of wing

### WESTON AERODESIGN WIDE CLOTH

The latest Weston Aerodesign catalogue is now available. Weston Aerodesign is a great source for wide glass, Kevlar and carbon-fiber cloth, and the prices are great. Frank Weston stocks 50- and 63-inch-wide glass cloth, 50- and 60-inch-wide Kevlar and 50-inch-wide CG/S-Glass cloth. The wide cloths make it easier to plan and cut the cloth for wing lay-ups. With 50-inch cloth, it's easy to cut the cloth for wing chords up to 12 inches. Just get a piece long enough

FIGURE 2

The longest panel you can cut on a 45-degree bias is a little more than 1.4 times the cloth width minus 2 times the wing chord. For example, with 60-inch-wide cloth, the maximum length panel with a 9-inch chord would be  $(1.4 \times 60) - (2 \times 9) = 66$  inches.



for half of the wingspan. The 63-inch-wide cloth is perfect for 45-degree bias lay-ups, i.e., where you cut the cloth at a 45-degree angle to its weave, on large wing panels. For example, it's wide enough for a 65-inch wing panel with a 10-inch chord (Figure 2).

### TRANSMITTER TOSS

There's more to contest flying than just the flights and landings. I especially enjoy the people I meet and the occasional event that's held just for fun. John Hauff of the Long

Island Silent Flyers has come up with a new event—the transmitter toss. The task consists of throwing a transmitter, either your own or a loaner, for a spot landing on a standard L4 landing tape.

At the inaugural event, there was a three-way tie and a toss-off was required before Tony Matyi emerged as the winner. Dig up some of your pre-1991 transmitters and give it a try at your next club contest.

### OBECHI SOURCE

Dave's Wood Products has moved. The new address is 12306 Bergstrasse, Leavenworth, WA, 98826; (509) 548-5201. Obuchi-sheeted





Bob McKeever of the Millstone Valley Silent Flyers demonstrates the underhand toss technique.

models were present in large numbers at the LSF Nationals this year. Give obechi a try if you're not already hooked on vacu-bagging fiberglass and carbon fiber (see the October '92 issue for my how-to article on using obechi).

### OPTIMUM CG SELECTION

Most sailplane fliers are familiar with the dive test as a way of finding a good CG setting. The test involves putting the sailplane in a dive of approximately 30 degrees and then releasing the stick back to neutral elevator. If the CG is too far forward, the nose rises and a series of stalls results. An increasing, steeper dive results when the CG is too far back. If the CG is right on, the dive will continue its near-30-degree course. Why do we want this behavior, and what's the best trim condition?

The CG location is a tradeoff; it influences how easy the glider is to control and also what is referred to as "trim drag." Trim drag refers to total induced drag when the combined drag of both the main wing and the tail plane is considered.

Moving the CG position changes both elevator sensitivity and the elevator neutral-trim position. Forward CGs are generally safe and easy to fly with, while rearward CGs are overly sensitive to elevator control. For minimal trim

drag, the tailplane lift should be zero to minimize the tailplane's induced drag. The

tail is a less efficient lifting device, so use it just for stability, not for lift.

The elevator trim position, in turn, slightly changes the main wing's angle of attack. This changes the main wing's induced drag because the main wing's lift coefficient changes as its angle of attack changes. Adjustment of the elevator trim also changes the induced drag resulting from the lift the tail is generating. Finally, the down wash from the main wing to the tailplane affects the tailplane's lift. The extent of this interference changes at different tailplane trim positions.

The trim drag effects are given by the

complex equation in the sidebar. This can be reduced to a simple equation that gives the best CG position for a particular lift coefficient (see the sidebar for the definition of terms). This equation is:

Equation 1

$$\frac{C_{mo}}{C_l} = h - h_0$$

To convert from dimensionless numbers to numbers you can use to find the CG in your model, we add two more terms—chord and MAC:

Equation 2

$$\left[ \frac{C_{mo}}{C_l} \times \text{Chord} \right] + \text{MAC} = \text{CG Position}$$

The equation is very simple. Pick a lift coefficient ( $C_l$ ), plug in the zero lift coefficient moment ( $C_{mo}$ ) and the mean aerody-

## TRIM DRAG EQUATION

A method for determining the trim drag coefficient is given by Vernon as:

Equation 1

$$C_{dt} = \frac{[C_{mo} + C_l(h - h_0)]^2}{\pi \cdot A} \left( \frac{c}{l_T} \right)^2 \left[ \left( \frac{b_w}{b_T} \right)^2 - 1 \right]$$

All the terms in the equation except  $C_l$  and  $h$  are characteristics of the design that can't be changed without modifying the sailplane. The position of the CG, i.e.,  $h$ , can be changed with some weight in the nose and  $C_l$  changes constantly during flight based on flight speed. From equation 1, the CG position for minimum trim drag can be determined for a particular lift coefficient quite easily. The position is found by the following equation (see example in main text):

Equation 2

$$\frac{C_{mo}}{C_l} = h - h_0$$

Where:

$C_{mo}$  -zero-lift pitching moment coefficient  
 $C_l$  -lift coefficient  
 $c$  -reference chord  
 $h$  -coordinate of CG on  $c$  in fractions of  $c$

$h_0$  -aerodynamic center coordinate on  $c$  in fractions of  $c$   
 $l_T$  -tailplane arm measured from the aerodynamic center  
 $b_T$  -tailplane span  
 $b_w$  -wingspan



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6x3, 6x3.5, 6x4 .....	10x6, 10x7, 10x8 .....	1.75
7x4, 7x6 .....	11x6, 11x7, 11x7.5, 11x9 ..	1.95

## K SERIES



black glass-filled nylon	14x6, 14x8 .....	\$4.95
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10x5, 10x6, 10x7, 10x8 .....	18x6, 18x8, 18x10 .....	13.95
11x6, 11x7, 11x8, 11x10 ..	20x6, 20x8, 20x10 .....	15.95
12x6, 12x8, 12x9 .....	22x8, 22x10, 22x12 .....	17.95
13x6, 13x8, 13x10 .....	24x8, 24x10, 24x12 .....	19.95

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## CENTER ON LIFT

namic chord (MAC) for the wing, and then calculate where the CG should be. A table of values for  $C_{mo}$  for many common airfoils can be found in *Soartech 8*. I have excerpted some in the chart.

## PITCHING MOMENT DATA

for some common airfoils

(From *Soartech 8*)

ISES code predictions for  $R_e=200,000$

SD8000 .....	-0.0493
MB253515 .....	-0.0495
E205 .....	-0.0543
RG15 .....	-0.0578
S3021 .....	-0.0597
E387 .....	-0.0817
Clark Y .....	-0.0873
S4061 .....	-0.0915
SD7032 .....	-0.0989
FX60-100 .....	-0.1201
E214 .....	-0.1382

I calculated the CG locations for several of my sailplanes. The thermal flying CG prediction, with the  $C_l$  just below the maximum for the airfoil, was very close to where I like the CG. For example, the pitching moment for a SD-8000 is -0.0493. For a  $C_l$  of 1.1, the CG location would be .0493/1.1 or 0.0448 wing chords from the MAC. If we put all of this into equation 2 above, for a MAC of 3.89 from the leading edge and a chord of 9.52, the CG location would be:

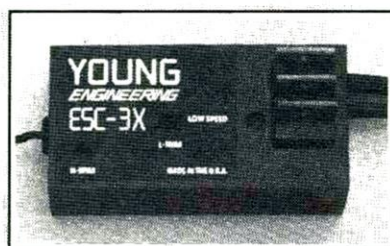
$$\left[ \frac{0.0493}{1.1} \times 9.52 \right] + 3.89 = 4.31 \text{ inches from the LE}$$

## HIGH- OR SLOW-SPEED FLIGHT?

One option is to optimize for a high lift coefficient. This makes sense for thermal flight since drag is minimized in slow flight in the high-lift conditions that exist while circling in thermals. This location is a little forward of where you would place the CG based on the dive test position. A drag penalty for higher speed flight exists when you select this CG.

(Continued on page 72)

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# PILOT PROJECTS

## A LOOK AT WHAT OUR READERS ARE DOING

### SEND IN YOUR SNAPSHOTS

*Model Airplane News is your magazine and, as always, we encourage reader participation. In "Pilot Projects," we feature pictures from you—our readers. Both color slides and color prints are acceptable.*

*All photos used in this section will be eligible for a grand prize of \$500, to be awarded at the end of 1992. The winner will be chosen from all entries published, so get a photo or two, plus a brief description, and send them in!*

*Send those pictures to:  
Pilot Projects,  
Model Airplane News,  
251 Danbury Rd.,  
Wilton, CT 06897.*



#### DRAKE II

The Drake II—an electric-powered, modified twin—was built from Ken Willard plans by Tony Turley of Dunbar, WY. Tony replaced the single .15-size glow engine with two Kyosho AP-29R geared motors. The model spans 43 inches and weighs 44 ounces for sea operation and 45.5 ounces for land operation. A Futaba Attack E controls the model, and it's

powered by a 7-cell SR 1100 Max battery pack. Tony says that the model flies very well on 7x6 props and that the water performance is better owing to the lighter wing loading.

#### HARDING'S HUDSON

This wonderful Lockheed Hudson-V is the handiwork of P.D. Harding of Spokane, WA. Weighing 23 pounds, it's powered by two Super Tigre .90 engines and has a Futaba 7-channel radio on board. Special features include operating flaps, scale bomb-bay doors with a functioning bomb drop, navigation lights, scale cockpit and cabin interior detailing, and homemade retractable landing gear. Constructed of plywood, the bomber has metal engine cowls and a scale exhaust system. Mr. Harding says it flies very well.



#### DUTCH WIGENS

Peter Klarenbeek and Henk Ialving of Groot-Ammer, Holland, sent us this shot of a quartet of Wigens Z-250s. Both pilots flew their models in the '91 F3A Championships in Holland. Peter placed second in Class B and Henk placed first in Class A. The models have epoxy/glass fuselages and balsa-sheeted foam wings. Peter's model weighs 18.25 pounds and is powered by an Olympic 55cc engine with a Seyen tuned pipe. The models are painted with automotive paint and are controlled by Robbe/Futaba radios and S3302 servos with pull/pull cable linkages.

#### SPYING BLACK WIDOW

This 8-pound, 7 1/2-foot-wingspan model, scratch-built by Ken McKinley of Longview, TX, was designed to carry a camera in the nose. It's powered by an O.S. .60 and controlled by a 6-channel PCM Futaba radio. Ken says that it's a very stable platform, yet it will do loops and aerobatics with ease. This three-tail, twin-boom eye in the sky can be disassembled into five pieces to simplify transportation.





TOP GUN AIRCRAFT

# Ultra Eagle *f-15*

*A sport-scale  
fighting jet*

by TONY ZAREMBA



PHOTOS BY TOM ATWOOD AND TONY GURCURIUTO

**D**UCTED-FAN KITS have been designed, as a general rule, after their full-scale counterparts. Several years ago, however, a new category of jets began to emerge. Sport- or stand-off scale jets began to show up at flying fields across the country. Sport-scale jets are similar in outline to full-size jets but have been modified to have better flying characteristics and handling qualities, i.e., less weight and lighter wing loads.

The Ultra Eagle from Top Gun Aircraft\* is one of the latest sport-scale jets. It would make an excellent first jet kit or a great addition to any seasoned pilot's stable of aircraft.

## THE KIT

The kit includes all the wood and hardware you'll need to build the aircraft. A highly detailed, photo-packed manual guides you through construction. The plane is reasonably priced, allowing budding jet pilots to get their feet wet without taking out a second mortgage.

## FUSELAGE

The kit comes with a one-piece, fiberglass, gelcoat fuselage that's virtually pinhole and defect free. All you need to do is sand the seam and fill seam imperfections with auto-body filler, and you'll be ready for priming and painting.





The canopy and the engine hatch are molded separately and fit nicely with a little trimming. There are only two main bulkhead formers. These are die-printed on a 1/4-inch ply sheet, and you must cut them out. The tail feathers are made of 1/4-inch balsa sheet and can be assembled quickly. The stabilizer incidence is pre-set in the fuselage.

#### ASSEMBLY

Assembly is relatively simple and progresses quickly. Working on it several hours a night, my first Ultra Eagle took approximately five weeks to complete. If you've built several low-wing "hot" sport ships or a pattern-type airplane, the Ultra Eagle will present no building surprises.

#### CONSTRUCTION

The wings are first to be built. Assemble the left and right cores and lightly sand them. Make 4 wing skins from the supplied 1/16-inch sheeting and trim them to allow a 3/4-inch overhang. To remove all dust and ensure a good bond, vacuum the cores and skins. Using your favorite bonding method, attach the skins to the cores and allow them to set. I prefer to put a light layer of epoxy on the skins and weigh down the cores in their saddle blocks overnight for a permanent bond.

#### SPECIFICATIONS

**Type:** Sport-scale ducted fan  
**Price:** \$299 (doesn't include engine, fan, retracts, or radio)  
**Wingspan:** 51 inches  
**Wing area:** 650 square inches (doesn't include lifting area of fuselage)  
**Wing loading:** 49.74 ounces per square foot (total area loading is lower)  
**Weight:** 12 1/2 pounds  
**Length:** 67 inches  
**No. of channels req'd:** 4 (aileron, throttle, elevator, steerable nose-gear)  
**Retracts:** optional  
**Radio used:** Airtronics® Spectra PCM  
**Fan:** Byrojet  
**Airfoil:** Symmetrical  
**Engine:** O.S. 91 ducted-fan engine  
**Wing construction:** Foam-core, sheeted with 1/16-inch balsa  
**Kit construction:** Fiberglass, foam, balsa and ply  
**Hits:**  
 • One-piece, fiberglass, gelcoat fuselage that's virtually pinhole free.

• All wood and many parts needed to complete the kit are included.  
 • Engine hatch and canopy are molded separately.  
 • Plane can be built with removable wings.  
 • Excellent field capabilities, great flight characteristics.

**Misses:**  
 • Right wing root and fuselage joint need to be shimmed to avoid inward cant of wing.



## FLIGHT PERFORMANCE

(Note: test pilot for review model was Rob McClellan.)

The Ultra Eagle is a great all-around sport jet. It offers the thrills of ducted-fan flight along with the simplicity, reliability and enjoyment of weekend sport flying. For flying reliability, I use 5-percent nitro with all castor oil jet fuel from S&W Hobby Supply\* and glow plugs from Jet Model Products\*. This is a very reliable combination that works well.

### • Takeoff and landing

Takeoffs with the Ultra Eagle are straight and true. Because this is a ducted fan there's no P factor to pull the aircraft to the side. This aircraft will track in a straight line; it requires few steering corrections. Climb-outs are positive and rock-solid. The aircraft doesn't exhibit sinking tendencies after rotation. Its landing habits are just as good as the takeoffs. On the downwind leg, go to half throttle and continue this into the base turn. Lower the landing gear and reduce power to quarter throttle. On final, let the aircraft lose altitude and settle in nose-high. When the plane is about 300 feet from the end of the runway, chop the throttle and flare in for a nose-high landing. The aircraft exhibits stability throughout the landing sequence.



### • High-speed performance

If you want to go fast, this plane fits the bill. Top-end speed in straight, level flight is approximately 120 to 130 mph. It tracks straight and doesn't drift at high speed. No trim changes were required throughout the flight—a credit to its design.

### • Low-speed performance

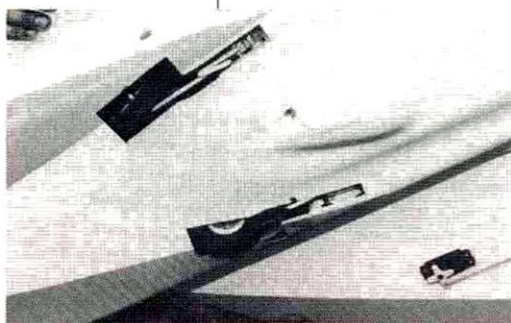
If you don't want to fly around at mach speed all day, don't worry. The Ultra Eagle flies as well at low speed as it does at full throttle. It's rock stable and doesn't fall off to the left or right. The stall characteristics of this plane are similar to the full-size F15 in that it doesn't wing snap but lowers the nose and continues straight forward. Dead-stick landings can be a jet pilot's worst nightmare. With some jets, if you lose the power, you could be in big trouble. Not so with the Ultra Eagle. On my second flight, I had a flameout on the downwind leg. I made a quick turn to final, dropped the gear, and set it down on the numbers. The plane doesn't drop like a rock when you lose power, and it's very stable in a dead-stick landing.

### • Aerobatics

Aerobatics with this plane will impress you. Rolls are lightning-fast and crisp. Slow rolls are positive with elevator input. It will sustain 90-degree turns without falling off or stalling out. Full outside loops are no problem, but do them at high altitude, because this plane requires more airspace than others for maneuvers. Inverted flight performance is also very good; no turn changes are required. Split S's, Immelmans, loops and rolls are all easily performed with the Ultra Eagle. When it's equipped with the O.S. 91 fan engine, vertical performance is just fantastic.

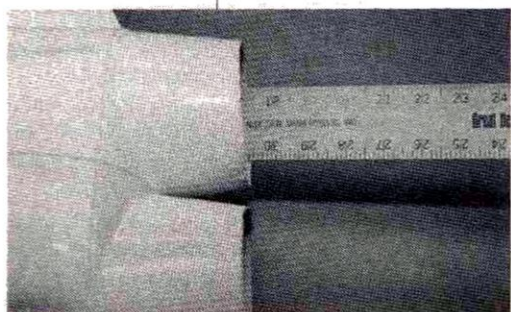
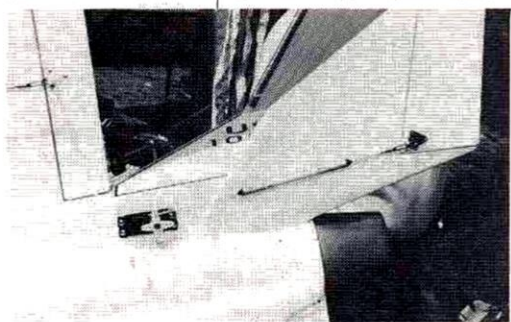
Trim the sheeting back to the cores and glue on the leading and trailing edges. Zap O\* odorless CA works well for wood-to-foam bonding. Cut and trim the ailerons to shape and mark the hinge locations. Also cut out the hinge slots. You should maintain a 1/4-inch gap between the trailing edge and aileron. Glue on the wing-tip blocks, carve them to shape and final-sand both wing assemblies.

Then, turn the wing panels over and cut out the servo cavities to the dimensions given in the instruction manual. Use a heated brass tube to cut a servo-wire channel from the wing root to the servo cavity. Glue the servo rails to the wing and then trial-fit the servo and wire through the wire channel. Final-sand the wings and set them aside.



## FUSELAGE

Cut out all formers from the 1/4-inch-ply, die-stamped former sheets. Trim the inside of the main engine former so the Byrojet\* shroud fits without binding. Install blind nuts and cut the notches for the servo wires. The Byrojet shroud must be trimmed down to fit properly in the fuselage. The easiest way to do this is to bolt the shroud to the former. Using the former as a guide, trim the shroud top and bottom so it matches the former's shape. A Dremel tool with a drum sander is best for this. When the former has been glued in place, final-trim the shroud so it fits into the fuselage former without binding.



At this point, you must decide whether you want removable or permanent wings. The spar mounts for the removable wings must be mounted as high as possible on the former, and it's much easier to do this with the former out of the fuselage. If you opt for removable wings, follow the instruction sheet. It's easy to do and it offers increased storage and transportation options.

If you choose permanently attached wings, final-fit the former and glue it in place. One note: before any gluing takes place, clean the inside of the fuselage with soapy water. This will remove any leftover mold release agent and leave a clean bonding area. To ensure a proper glue bond, sand the areas to be glued with 40 to 80 grit paper.

When the former has been trimmed and final-fitted, install it in the fuselage by butting the former against the rear engine internal hatch lip. The former must be 90 degrees to the center line of the aircraft. You can check the alignment by measuring with a yardstick from the rear left and right sides of the former to the outer edge of the rear tail cones. Also

## ULTRA EAGLE F-15

Top to bottom: the main gear retracts into the lower fuselage. Note the simple setup. ■ The elevator is actuated with a simple, externally mounted linkage. The servo is secured to the fiberglass fuselage. ■ To ensure proper former alignment, measure from the rear of the former to the tail cones.



## ULTRA EAGLE F-15

measure from the right and left wing-spar mounting areas to the rear tail cones. The measurements must all be equal.

Take your time here, because the position of this former determines

wing-spar and fan-shroud final alignment. Field testing has shown that the addition of several cooling slots at the top of the intake formers gives better engine performance. When you've finished the final alignment, fiberglass the former, front and rear, into place.

Cut and trim the nose-gear former and prepare to install it in the fuselage.

If you're going to install retracts, mount the nose-gear unit now. Draw a center line on the bulkhead and measure  $2\frac{5}{16}$  inches from the top. This is where the top of the nose-gear unit should be located. Using blind nuts and 6-32 bolts, install the unit.

Cut out the main retract plates and mount the main gear to the tops of the plates. Remove the retract units, roughen up the glue area, and install the former and plates as per the instruction manual. Don't forget to use 6-ounce fiberglass cloth to reinforce the former and landing-gear plate areas.

The length of the nose-gear strut from the bottom of the fuselage to the axle center line is  $4\frac{1}{2}$  inches. The main gear length from the fuselage bottom to the axle center line is 4 inches. These measurements are based on Spring Air\* heavy-duty landing gear (no. 102), which is just great for this installation. Any other gear installation may require custom fitting. If you've chosen a fixed gear, follow the directions. The aircraft will also fly well with fixed gear.

Mount the retract air support gear in the front of the aircraft. Make sure that the internal components don't interfere with retract

operation. How to cut out the retract doors depends on the type of gear and the building techniques that you use.

Mount the throttle servo on the lower back of the nose-gear former.

Temporarily attach the engine and fan to the main former. Make a throttle-linkage rod out of a fiberglass arrow shaft. Final adjustments will be made after the plane is finished. Next, above the throttle servo, build and mount the receiver platform. Drill several  $\frac{1}{4}$ -inch holes in the platform base. This will allow access to the throttle servo below, in case you need to service the assembly.

With the engine still temporarily installed, slip on the header and the tuned

pipe. Slide the pipe out until the distance between the high point of the pipe and the center of the glow plug is approximately  $11\frac{3}{4}$  inches. Put the plywood tuned-pipe mount over the forward end of the pipe, tack-glue it in place and remove the pipe and engine assembly.

Secure the mount with glass cloth and resin, and install the  $\frac{1}{2}$ -inch-ply intake formers. Use your favorite filler to blend the plates into the fuselage. While you wait for epoxy to cure, assemble the supplied fuel tanks, build the tank supports and install them in the fuselage as per instructions. Make sure you mark the vent and feed lines. Follow the enclosed tank hook-up sheet during the final assembly stage.

Turn the fuselage upside down and mark and cut out the elevator servo openings to fit your equipment. Also cut out the servo mounting plates and secure them with glass cloth and resin. At this point, go back and check all your work. Trim off any excess cloth, check all glue joints and prepare to install the wings. I won't go into a step by step, detailed list of how to do it. The most important thing is to make sure that the fuselage is blocked up and sitting at equal

measurement from front to back and left to right.

Weigh the fuselage down so it can't be moved easily, and then use shims to make all measurements equal. Follow the manual and glue

on the wings, or use the instruction sheet and build the removable wing. One note: the right fuselage wing root has a slight inward angle in comparison with the left. This creates a gap that must be filled during wing installation.

### TAIL SURFACES

Assemble the tail surface using the  $\frac{1}{4}$ -inch balsa sheets. Round the leading and trailing edges and cut the hinge slots. Attach the surfaces as per the instruction manual during final assembly. The stabilizer has the correct angle of inci-

dence built in. However, if you want to measure just to be sure, start with the wings at 0 degrees incidence. Now measure the rear stabilizers. They should have -0.5 degree to -1 degree incidence in relation to the wing. Minor shimming of the left stabilizer may be necessary to achieve this. Properly aligned flying surfaces are the key to an airplane that flies well. Make sure that the left and right measurements are equal.

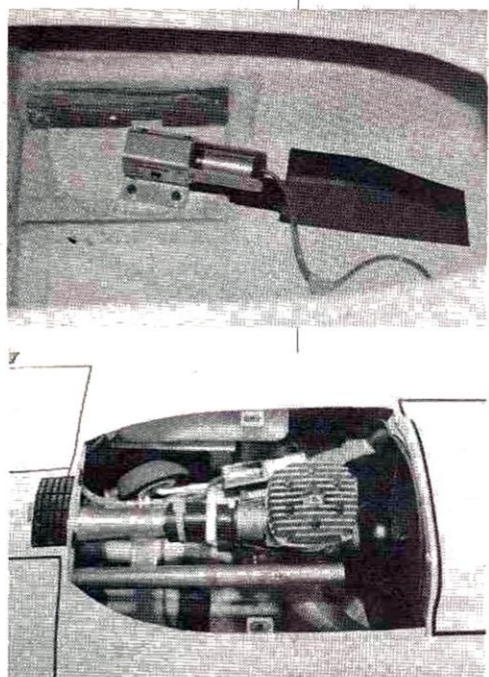
Glue on the vertical fins and make sure that they're 90 degrees to the horizontal stabs. Add the rear tail plane extensions and fill in any gaps. You may add fillets at all fuselage joint areas if you want to improve the plane's appearance.

Install the latches and pins in the canopy and the engine hatch. Take your time to achieve a good fit.

### BUTTON IT UP

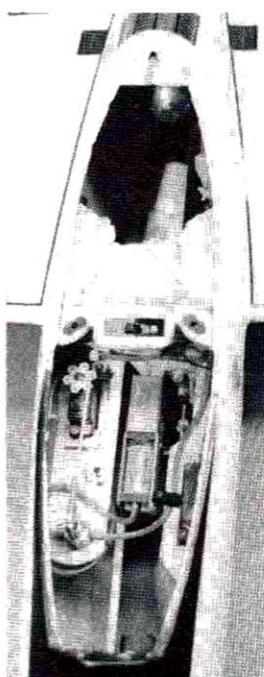
Now is a good time to make up all servo-wire extensions. Mount the receiver and servos and route the extensions from the receiver area to the servos. Trim the extensions to length, add the servo ends, and test for proper operation. Tack-glue the wires down so they won't thrash around during flight. Electronic noise traps work well in this application.

(Continued on page 89)



Top: left retract plate and retract unit installed. Note main gear door opening shape. ■ Above: here's the Byrojet power package installed and ready for duty. ■ Right: here's a picture of the pneumatic and nose-gear installation.

*"For the money, the Ultra Eagle is a bargain that's hard to beat. It offers a quick, relatively inexpensive way to enter the ducted-fan scene."*



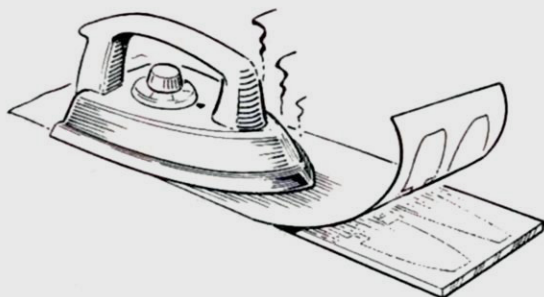


# HINTS & KINKS

J I M N E W M A N



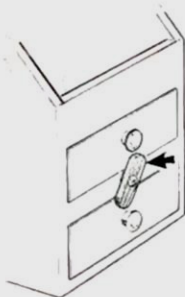
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## DRAWING HEAT TRANSFER

Instead of laboriously tracing parts onto balsa wood, make photocopies of the parts and lay the copy on the wood with the print side down. Using a hot iron, iron the back of the copy to transfer the image to the wood.

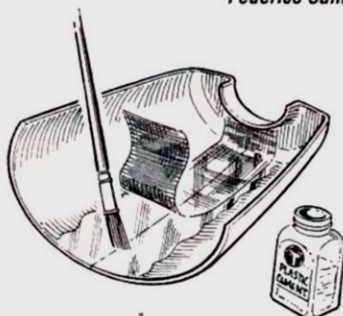
*Bob Beecroft, Carlsbad, CA*



## DRAWER SECURITY

To prevent the drawers of your field box from sliding open while you carry it, make this simple turn latch out of a piece of plywood and add a thin plastic washer behind it for easy operation.

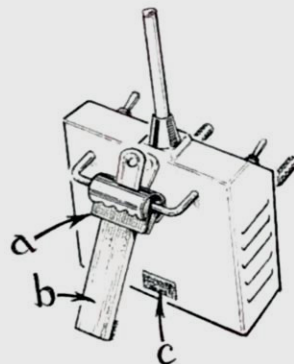
*Federico Campos, New York, NY*



## STRONG PLASTIC JOINTS

To assemble plastic parts, e.g., cowls or wheel pants, tack-glue the pieces together with CA, then brush the inside of the seam with liquid plastic model cement or acetone. While the cement is still wet, press fiberglass tape into the softened plastic surface, then apply more liquid cement. The glass tape will virtually melt into the surface of the plastic and form a nearly indestructible bond when wicked with CA. This technique can be used to reinforce cowls, etc., and it virtually eliminates the cracks that vibration can cause.

*Major Tim Hudson, APO, Germany*



## HANDY TRANSMITTER STAND

Make a handy transmitter stand out of a large spring paper clamp (a) and a piece of paint stirrer or plywood (b). When not in use, the stand can be folded flat and secured with Velcro® (c).

*Bob Austino, Vineland, NJ*



## MONOKOTE FILLET TOOL

Select a spoon that fits the radius of the model fillet, then heat it up to the required temperature with your MonoKote iron. Use the spoon to burnish the film onto the fillet for a smooth finish.

*Harold C. Webb, Delta, CO*



## ARF REPAIR

For a plywood-constructed ARF: cut away the covering; force the broken halves together, make sure that they're aligned and tack-glue them with CA. Place reinforcing plywood patches inside, then mark and drill through the fuselage and the patches for 10-32 screws. Generously apply white glue to the patches before you re-apply them and temporarily clamp with screws, nuts and washers on each side. When the glue has set, the screws, etc., can be removed. Then sand the fuselage and patch it with covering film. You don't have to fill the screw holes.

*Salvador Sordo, Col. del Valle, Mexico*





## DESIGN CONTEST WINNER

TIE FOR **5<sup>TH</sup>** PLACE

by STAN RUTZ

**S**OMETIMES, IN THE midst of creating my next master-scale, giant, Top Gun, ducted-fan amphibious Schneider unlimited warbird, I have to stop and throw something simple together, just to keep my perspective.

There's something pure and refreshing about a .15-powered generic model airplane that will fly all day on a pint of fuel. But it should be slippery enough to handle wind, and it wouldn't hurt if it could takeoff anywhere, climb like a rocket and land like a parachute. Why not have it thermal and slope soar, then get down and howl in a circle like a U-control. And it should look



PHOTO BY STAN RUTZ

great, have at least a 6-foot wing, be stable enough to be flown by visitors, be dirt cheap and be built by first-timers in less than a week.

### NO PROBLEM AT ALL —START WITH THE WING

Have you noticed the fine wing Dynaflyte\* has on its Piece O'Cake: 6-foot span, great balsa, webbed basswood spars, polyhedral, tapered panels—overkill for an .049, but perfect for a .15 Supercake uses a version of that wing, and hardware and much of the wood from that kit (most of the fuselage and tail wood can be used for other projects).

Extend the 1/8-inch-square basswood spars to meet at the center line. Reduce polyhedral to 1 3/4 inches at each joint.

Join the halves before sheeting the center section with hard balsa, bending it (the uncut sheeting) at the center line for strength. Insert triangular gussets in the trailing edge at each rib.

For prettier wing tips (and four more inches of wing), cut their tops from 1/16 inch balsa sheet (grain spanwise). Butt glue them against the top edge of the tip ribs, bending them to conform to the curve. Glue 1/16 inch balsa tip bottoms (grain chordwise) to the rib bottoms

## A QUICK PIECE-A-CAKE CONVERSION



# Supercake



and curved top sheets. Sand the wing, and cover it with transparent MonoKote\* to show off your work.

## THE FUSELAGE

When you have that beautiful wing, you're unstoppable. Build the fuselage sides on the plan with hard, 1/4-inch-square balsa, pins, a razor saw and CA. Use Mono-Kote backing to prevent parts from stock- ing to the plans.

The straight longeron helps to ensure zero thrust offset and zero-incidence wing and stab mounts. The upper and lower longerons curve gently to make the fuselage a lifting airfoil like that on the Short 360 airliner. The "Warren-truss" design, i.e., typical stick construction, offers triangular rigidity and maximum gluing area.

With a sanding block, taper the inside rear of both sides (see top view). Stand them upright on a flat surface, and join them at the rear with CA. While constantly sight-checking the frames' symmetry and squareness, install upper, center and lower cross members, running from the rear to the front (use light rubber bands to bow the sides inward during assembly). Install double-deep cross members at the front and rear of the wing saddle.

Cut a 1/4-inch wide, 1/8-inch deep, center slot in the 3 1/2-inch landing-gear block. Make the gear legs by bending 1/8x11-inch piano wire and install them side by side in the slot, holding them with two straps and four screws (pre-drill the screw holes). Notch the ends of the block to take the vertical part of the legs, and install the block in the fuselage with CA.

In the short blocks, cut a 1/8-inch-square slot, 1/8

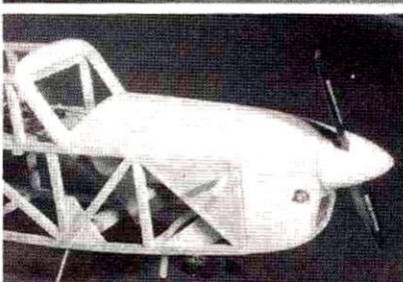
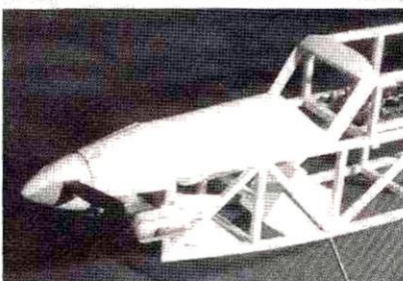
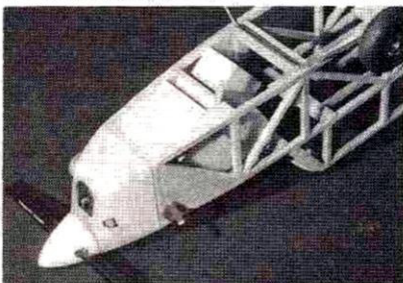
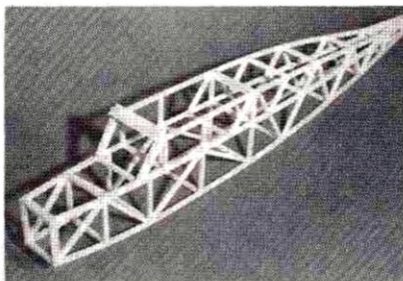
inch off center. Glue the blocks to the long block and vertical frame. Brace them with 1/8-inch balsa triangles. Make the tail-wheel strut by bending 1/16-inch piano wire, which is sandwiched between two balsa triangles glued between the longerons. Install 2.25-inch Du-Bro\* main wheels and a 3/4-inch tail wheel, and your bird will roll.

Fill the fuselage's front frame with 1/4-inch

balsa, and add the 1/4-inch-thick top former. Glue the plywood firewall to the front of the frame, and glue the ply "backer" behind it to form a ply-balsa-ply sandwich. Observing the thrust line, drill three radial mount holes through the sandwich. Install blind nuts in these holes, and mount your engine inverted.

Note: adapt the nose to your engine. I use the short, radial-mounted HB 15, but the O.S.\* 20 or 26 FS work beautifully in a shorter nose. Remember that this is a zero, zero, zero airplane, with no thrust or vertical-fin offset, and no wing or stab incidence.

Assemble the 1/16-inch balsa cooling tunnel and finish cutting the hole through the firewall, beveling the edges to fit the tunnel. Install it between the firewall and the next bottom cross member. Inlay 1/16 inch balsa around the tunnel exit. Install a 4-ounce fuel tank (I use one from Sullivan Products\*) above the tunnel, with the vent lines and feed lines going through the firewall and the filler line exiting through a



*Top to bottom: •The strong, light fuselage is of a typical stick construction. The sides are built flat over the plans. •The underside of engine cowl and bottom fuselage sheeting. Note the balsa cooling tunnel. •The top of the engine cowl starts to take shape. The forward fuselage decking is moistened with ammonia and water before being bent to shape. •The finished engine cowl is ready to be sealed and finished. Note the needle-valve access hole on the side.*

## SPECIFICATIONS

Type: Sport trainer

Wingspan: 76 inches

Chord: 8 1/2 inches

Wing area: 590 square inches

Weight: 2 pounds, 12 ounces (dry)

Wing loading: 11 ounces/square foot

Airfoil: Clark Y

Polyhedral: 13/4 inches at each break

Lifting stab: 164 square inches

Fuselage length: 45 1/2 inches

Construction: Balsa and basswood/

MonoKote covering

Engine: HB 15

Propeller: 8x4 Master Airscrew

Radio: 4-channel Futaba Conquest with three servos

## MATERIALS

### Balsa

- 2—1/16x3x36 inches
- 4—1/16x15/16x36 inches
- 1—1/16x2x20 inches
- 3—1/8x1/8x36 inches
- 1—1/8x1/8x36 inches\*
- 1—1/8x1/4x36 inches
- 1—1/8x3x15 inches
- 3—3/16x1/2x36 inches\*
- 2—1/4x1/4x24 inches
- 14—1/4x1/4x36 inches\*
- 2—1/4x1/2x18 inches
- 1—1/4x3x6 inches\*

### Basswood

- 4—1/8x1/8x18 inches
- 8—1/8x1/4x18 inches
- 2—1/4x1/4x5 1/4 inches\*

### Plywood

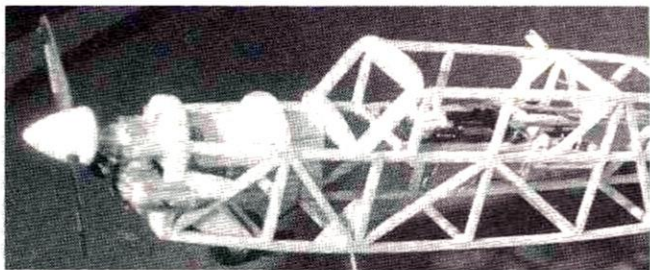
- 1/16x2 1/4x11 inches
- 1/32x3x6 inches

### Miscellaneous

- Set of 1/16-inch wing ribs
- 6—1/16-inch ply dihedral braces
- 2 pieces of 1/16x4-inch piano wire
- 4—rudder hinges
- 2 Dynafite Ziphorns
- 1/8x5 1/2 inches dowel
- 1/8x5 1/2-inch dowel\*
- 1 piece 8x10-inch 20mil clear plastic\*
- 2—24-inch Sullivan Gold-N-Rods\*
- 1/34-inch Du-Bro spinner\*
- 2—rolls MonoKote\*
- 1—1/4x3/4x7-inch gear block\*
- 1 pair 2 1/4-inch Du-Bro wheels\*
- 4-ounce Sullivan fuel tank\*
- 2-ounce Bullet CA glue\*
- 1/8x11-inch piano wire\*
- 1/32x12-inch piano wire\*
- 3/4-inch tail wheel\*

\*Parts not included in the Piece O'Cake kit





The fuselage under construction with the engine and radio installed. The sheet-balsa engine cowl is built up around the engine.

<sup>1</sup>/<sub>16</sub>-inch balsa triangle next to the tunnel.

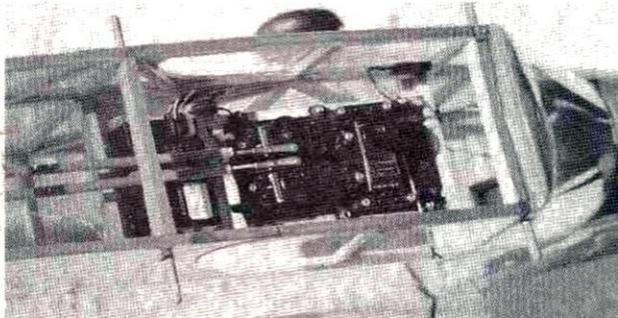
Install the deck formers. Cut the deck halves out of <sup>1</sup>/<sub>8</sub>-inch balsa, and join them at the center line. Bevel the long edges to meet the top long-erons. Soak the deck in ammonia and water it until it's pliable. Blot it and install it while it's damp, holding it in place with rubber bands while adjusting the fit to make sure the joints between the deck and the windshield side bars is tight. When you're satisfied, apply the CA.

Glue in the wing-mounting dowels. By cutting and trying, shape a shallow vee in the cross members at the

front and rear of the wing saddle to accept the wing's dihedral. Again using the cut-and-try method, build up the windshield header with <sup>1</sup>/<sub>4</sub>-inch-square balsa so that it curls around the wing leading edge. This acts as a wing locator and

## HORIZONTAL STAB AND ELEVATORS

The stab spars taper up to produce a straight top



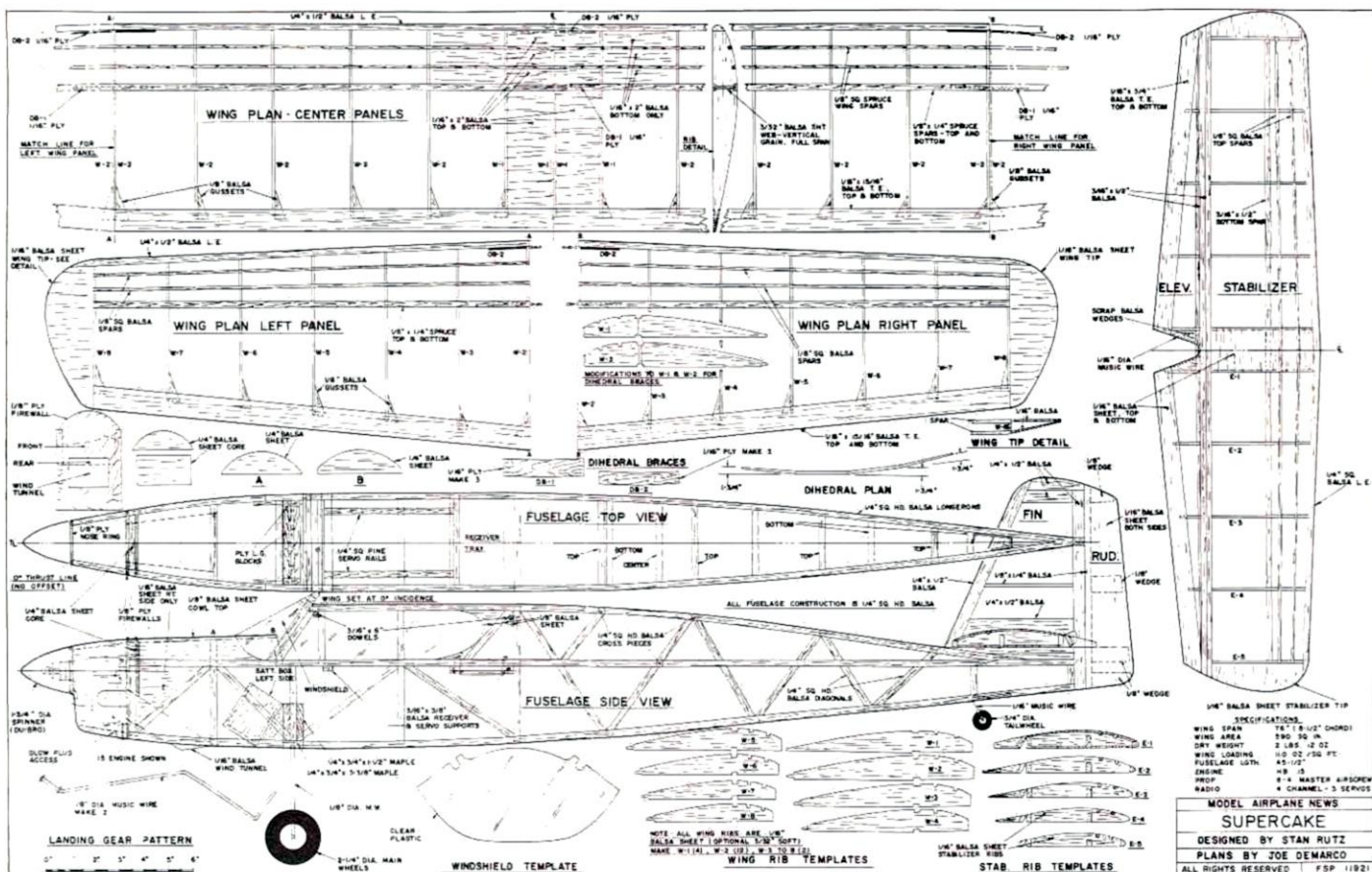
The radio system is straightforward and easy to install. The on/off switch extension is installed through a hole in the window.

hinge line. This requires that half of the stab spar be built first. It's then raised off the plan at the tip so the other half can be built and attached. It's easy—harder to say than to do. Make three stab and elevator spars out of rigid <sup>3</sup>/<sub>16</sub>x<sup>1</sup>/<sub>2</sub>-inch balsa, keeping their 2-inch center sections at full depth. Taper the bottoms of the spar up to a <sup>1</sup>/<sub>4</sub>-inch thickness at the tips. Cut four trailing edges and 10 ribs out of firm, <sup>1</sup>/<sub>16</sub>-inch balsa. Tilt the elevator spar forward 30 degrees, and bevel the top and bottom edges accordingly.

To hinge the elevator to the stab, lay it upside-down on the stab, upper edge to upper edge, and join them by ironing a strip of MonoKote onto the rear of the stab and the front of the elevator. Fold the MonoKote at the hinge line, and install the <sup>1</sup>/<sub>16</sub>-inch, piano-wire elevator joiner. Sheet the center section, top and bottom, with firm <sup>1</sup>/<sub>16</sub>-inch balsa (run the grain spanwise). Install the stab tips in the same way as you installed the wing tips.

Align the stab and fuselage, and tack-glue the stab into place. Attach the wing and, sighting along it from the rear, verify that both stab tips seem to touch the wing trailing edge simultaneously. If necessary, adjust the tips, before final-gluing them into place.

ORDER THE FULL-SIZE PLANS ON PAGE 130





# Supercake

## VERTICAL FIN AND RUDDER

Here's an easy one. Glue a  $\frac{1}{4} \times \frac{1}{2} \times 8$ -inch rudder post to the rear of the fuselage, perpendicular to the stab. Cut a fan-shaped relief to ensure free elevator movement. Cut the top and bottom fin formers out of  $\frac{1}{4}$ -inch balsa, and glue them into place, aligning them with the fuselage center line. Add a  $\frac{1}{4} \times \frac{1}{2}$ -inch leading edge and two  $\frac{1}{8} \times \frac{1}{4}$  inch crossbars.

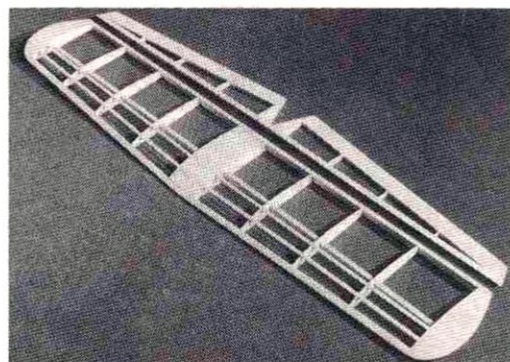
Cut two rudder sides out of  $\frac{1}{16}$ -inch balsa,

and glue one of them to the side of the  $\frac{1}{8} \times \frac{1}{4}$ -inch spar. Install balsa wedges at the top, bottom and control horn position, then add the second side. Join the rudder to the fin with four hinges.

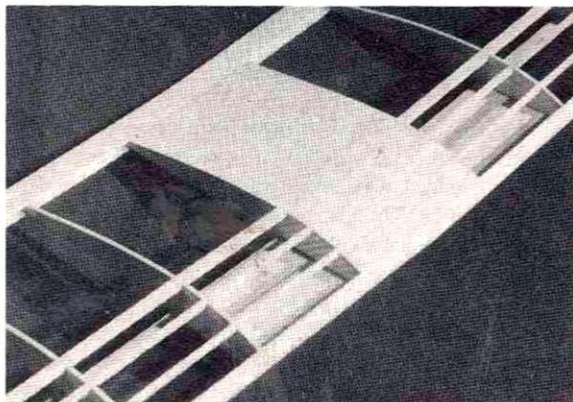
## RADIO INSTALLATION

Glue three  $\frac{1}{2} \times \frac{1}{4}$ -inch cross-supports to the bottom of the center longerons, as shown. Screw your servo tray to two  $\frac{1}{4}$ -inch-square,  $5\frac{1}{4}$ -inch-long, basswood rails, then glue the rails to the first and second supports.

Glue a  $\frac{1}{8}$ -inch balsa floor under the second and third supports. Bend a receiver-hold-down hook and install it so that it goes through the floor. To protect the receiver, put a  $\frac{1}{4}$ -inch foam pad between the hooks. Make a battery box out of  $\frac{1}{8}$ -inch-thick balsa, and line it snugly with  $\frac{1}{4}$ -inch foam, open at the top. Glue the box to the front of the left landing-gear-block brace and the fuselage frame. Install two 24-inch Sullivan Gold-N-



*The completed stab and elevator, ready to cover. The stab tapers from the center to the tip.*



*The strengthened wing center section. Notice that the wing's center sheeting isn't split at the dihedral break, but it bends slightly in the center.*

Rods,  $\frac{1}{2}$ -inch apart, on the top of the center cross-member behind the wing; they should exit through the narrow triangles below the stab leading edge. To align the rods with the horns installed in the rudder and elevator, cut away the framing as necessary. Install the throttle pushrod through the firewall, avoiding metal-to-metal contact.

## ENGINE COWL—STRONG AND QUICK

At the upper longerons and bottom center, glue three,  $\frac{1}{2}$ -inch pieces of  $\frac{1}{4}$ -inch-square bass-

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	.90 4-cycle

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# Supercake

wood to the firewall to take the cowl screws ( $3/16$  inch from the edge). Cut out two  $1/16 \times 1/4 \times 1 3/4$ -inch rings, one of balsa and the other of plywood. Tack-glue the balsa to the spinner backplate to set the clearance, and tack-glue the plywood to the balsa, which is attached to the backplate. Install the engine, muffler, prop and spinner.

Build the cowl around the engine and muffler, spanning the gap between the firewall and the plywood ring with short pieces of  $1/4$ -inch-square balsa. Start at the top. Glue balsa pieces to the ring and to one another (not to the firewall). Bevel the pieces to fit the curves. You can allow the rough cowl to be  $1/16$  inch larger than the firewall and ring.

At the longer-ends, drill through the balsa and into the basswood and install the screws. Work down the sides, and form a cooling hole below the ring. As you go, cut out a muffler slot, needle-valve and glow-plug holes, and a bottom mounting-screw hole. Use short pieces to sculpt the shape you want. Sand the assembly to a curve that runs smoothly from the spinner to the nose deck, then remove the spinner and discard the balsa spacer ring. Coat the firewall and the inside of the cowl and wind tunnel with CA.

## COVERING

Apply transparent MonoKote to all the outer surfaces, including the cowl, the window frames and the windshield header. Cover the stab and elevator tops with the same piece of MonoKote, leaving it intact at the hinge line. Cut a windshield and windows out of 20mil acetate and use CA to glue them sparingly to the MonoKote (rotate the fuselage to keep the acetate above the point of application). Make exit holes for the switch extension and the charging plug in the right window. Apply  $1/4$ -inch striping tape to the deck/windshield joint.

Cut wheel covers out of soda-can bottoms, and glue them to the wheels with Zap-a-Dap-a-Goo\*. Tint thinned clear dope with colored

dope and apply it to the bare surfaces (wheel covers, gear legs, spinner, wood, etc.). Use several light coats to intensify the color until it matches the MonoKote.

## FLYING—THE PAYOFF

With the tank empty, the CG is at the main spar, and Supercake should fly without ballast and without needing any equipment adjustments. Just put a few extra rubber bands on the wing.

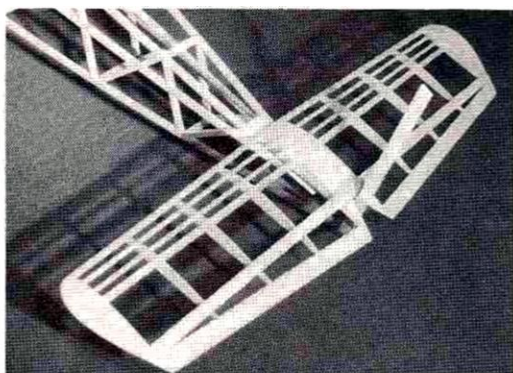
Expect two surprises: it's so fast that you might be hit by the 76-inch wing before you can get out of the way; and the tail comes up immediately.

Supercake's first flight was off the ice on Muskegon Lake, MI, on January 9 in the 12- to 15-knot wind. In that wind, takeoff roll was short to nonexistent, and climb-out was spectacular—straight and fast, with solid penetration. Rudder control

was excellent; the plane banked easily to the left and the right. The lifting stab allows full-throttle level flight with elevators neutral (Cahill and Korda heritage). With the engine off, it floated, dove and looped. Hanging on the wind, it parachuted downward. With neutral elevator, it penetrated slowly, but a little up-elevator allowed it to drift backwards.

The I tried U-control—letting it tear around in a 150-foot circle in a nearly vertical bank with its wing tip 10 to 15 feet off the ice. After five dizzy circles, I let it climb straight away—something we couldn't do on wires. Then it was time for touch-and-goes. With the engine idling, I flew it down to the ice and held it there, motionless, with its tail up; then full throttle, and it climbed like a rocket.

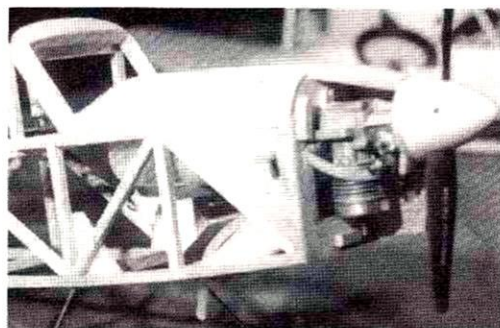
A fellow club member wouldn't accept that it couldn't fly inverted with all that polyhedral, so



*The completed horizontal stab is fitted to the fuselage, then the vertical tail post for the fin is positioned to ensure the alignment of the fin and the rudder.*



*The flat-bottom stab can be easily attached to the fuselage—at 0 degrees incidence. The elevator is hinged and sealed with MonoKote.*



*The spinner is installed on the prop shaft to help with the forming of the wooden cowl.*

he half-looped and made two big inverted circles without a problem (he thought). After it had landed, we found that the battery had fallen out of its tight box and was behind the wing. Bless the Futaba\* plug for not coming apart! That's why I recommend that you run a strap across the top of the battery box.

A week later, I shared Lake Michigan beach with a friend flying a Hawaiian stunt kite, whose flutter was louder than my engine. In that wind, I could hang Supercake motionless and then rocket downwind. When the engine died 300 feet up and 100 yards upwind, I was able to glide it backwards to land at my feet, with solid control all the way down.

In the past year, I've flown Supercake every month—slope soaring with the gulls over Lake Michigan sand dunes, thermalling with the hawks over our field and just generally showing off. Not too bad for a plane that was conceived as a diversion! I did manage to break it last summer

when I abruptly did a split-S from a wide-open inverted dive—after had I chickened out of a low, inverted pass—but it's easy to repair. The plans reflect the resulting beefing-up.

There you have it! I hope you'll find Supercake a piece of cake.

Here are the addresses of the companies mentioned in this article:  
 Dynafite, 1578 Osage, San Marcos, CA 92069.  
 MonoKote/Great Planes Model Distributors, P.O. Box 9021, Champaign, IL 61826.  
 Du-Bro Products, 480 Bonner Rd., Wauconda, IL 60084.  
 O.S./Great Planes Model Distributors.  
 Sullivan Products, P.O. Box 5166, 1 North Haven St., Baltimore, MD 21224.  
 Zap-a-Dap-a-Goo; distributed by Frank Tiano Enterprises, 15300 Estancia Ln., W. Palm Beach, FL 33414.  
 Futaba Corp. of America, 4 Studebaker, Irvine, CA 92718.  
 Master Aircrow; distributed by Windsor Propeller Co., 3219 Monier Circle, Rancho Cordova, CA 95742.



# Propeller Selection, Part 1

by ANDY LENNON

## Basic principles

THE WIDE VARIETY of propeller makes, shapes, materials, diameters and pitches available today can be somewhat confusing.

The choice of a prop to suit your model, its engine and your style of flying requires some understanding of how a propeller functions. It also requires an appraisal of the weight, wing area and aerodynamic drag of your airplane and of the power loading of the model—plus some insight into its engine's power characteristics.

In addition, the propeller's high-speed rotation leads to effects that every modeler should be aware of. These are:

- Slip-stream
- Asymmetrical blade effect
- Propeller pitching moment
- Torque
- Gyroscopic precession

This two-part series will cover these points and help to narrow propeller choice for a given model to one or two diameters and pitches.

### PROPELLER ACTION

A propeller generates thrust by forcing a column of air backward—called the “slip-stream” as in Figure 1. In the slip-stream, the air's velocity is increased above the aircraft's forward speed, and its pressure is reduced. In addition, a substantial part of this increase occurs ahead of the propeller.

This slip-stream swirls around the fuselage in the same direction as the propeller rotation.

### A PAIR OF WINGS

A two-blade “prop” is actually a pair of small wings; each has an airfoil cross section that is thick close to the hub for strength and rigidity, and that tapers to the tips. These small airfoils have all the characteristics of a wing's airfoil. They have:

- A chord line
- An angle of zero lift
- A stalling angle
- Increasing profile and induced drags as their angle of attack increases
- A pitching moment
- Upwash ahead, and wake and downwash behind the blades

Propeller blades differ from the wing's airfoil in that they operate at much higher speeds than the wing. A 12-inch-diameter propeller that advances 5 inches per revolution and turns at 10,000rpm has a tip speed of 360mph, while the model it propels flies at only 47mph.

A wing normally flies at the same speed across its span. A propeller, however, operates at different speeds: high at the tip and progressively slower from tip to root. At half its diameter, its speed is half that at the tip.

Stresses on the propeller are high, particularly at its center. These stresses result from a combination of centrifugal and thrust forces, plus the blade's airfoil pitching moment trying to twist them.

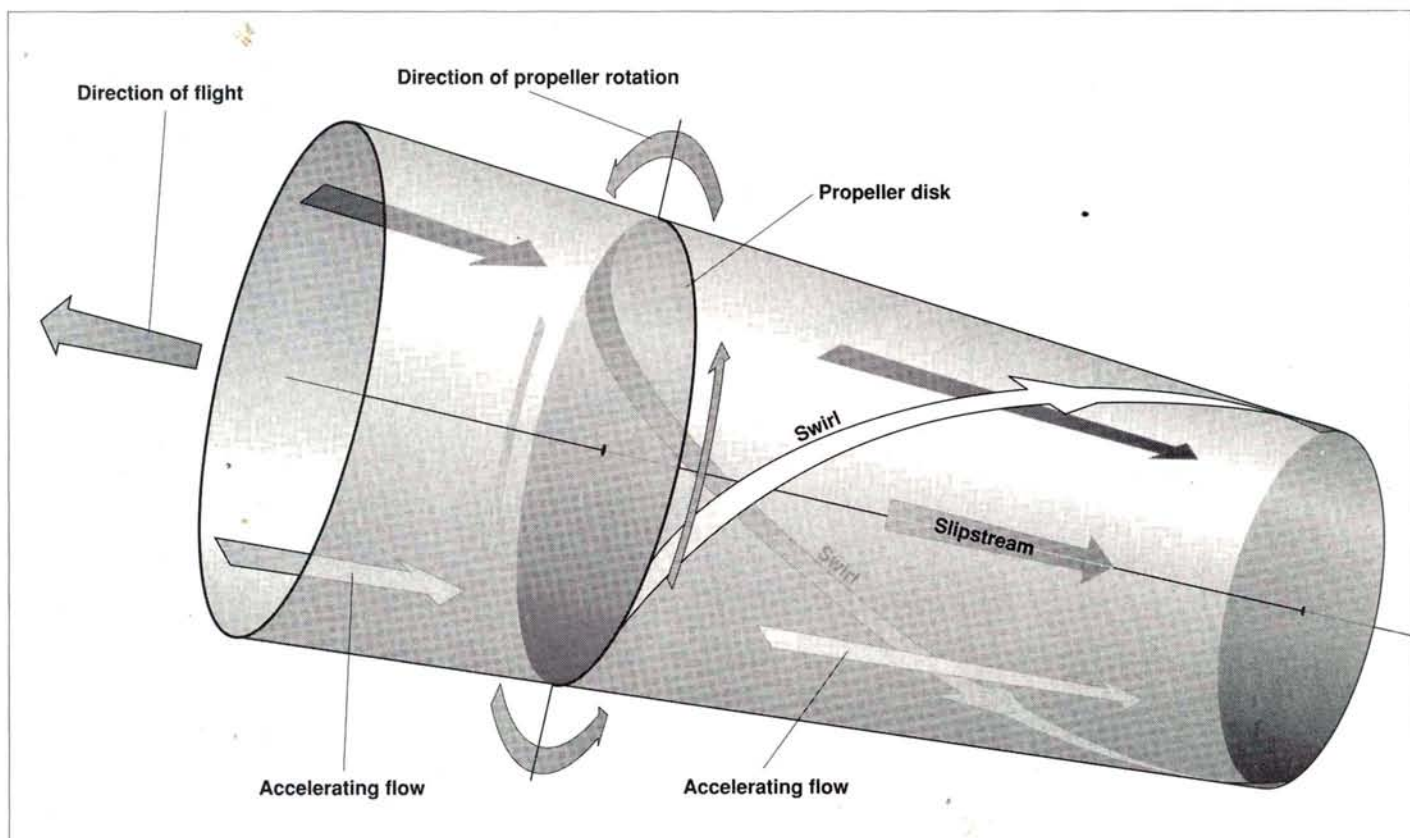
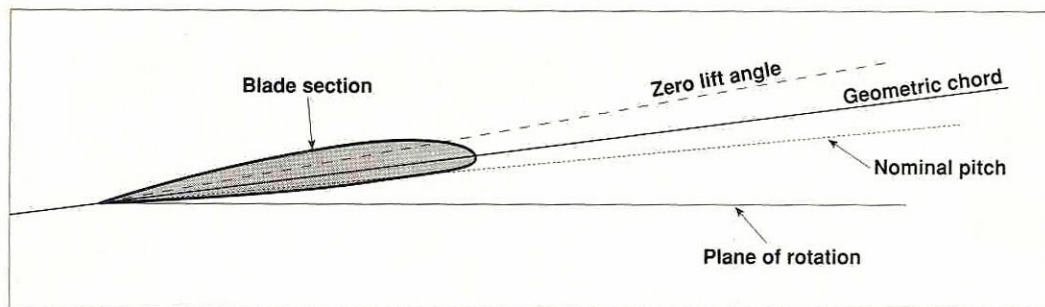


FIGURE 1. The Propeller's Action





**FIGURE 2. Propeller Pitches**

### DIAMETER AND PITCH

Propellers are sized in both diameter and pitch in inches. Diameter is simply the length of the prop, tip to tip. It identifies the size of the imaginary cylinder in which the prop rotates and advances. Increasing the diameter increases the load on the engine and reduces its rpm.

For each prop diameter, there are several different pitches available. For example, a 10-inch-diameter prop is typically offered in pitches from 6 inches to 10 inches. The higher the pitch, theoretically, the greater the advance per revolution, and the higher the engine load—again, reducing its rpm.

Thus, both diameter and pitch must be considered in propeller selection. For high-speed flight, reduced diameter and increased pitch apply; for slower flight, increased diameter and lower pitch prevails.

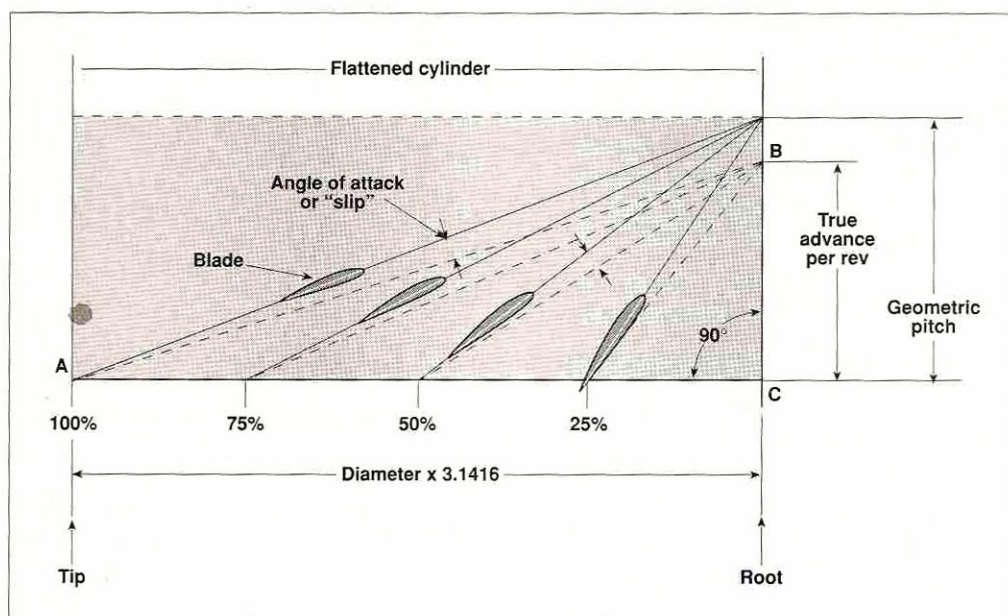
There are several variations for a given pitch dimension, as follows (see Figure 2).

- The “nominal pitch” is measured across the flat back surface of the blade—usually measured at 75 percent of the diameter. This is what you buy!
- The “geometric pitch” is measured across the airfoil’s chord line.

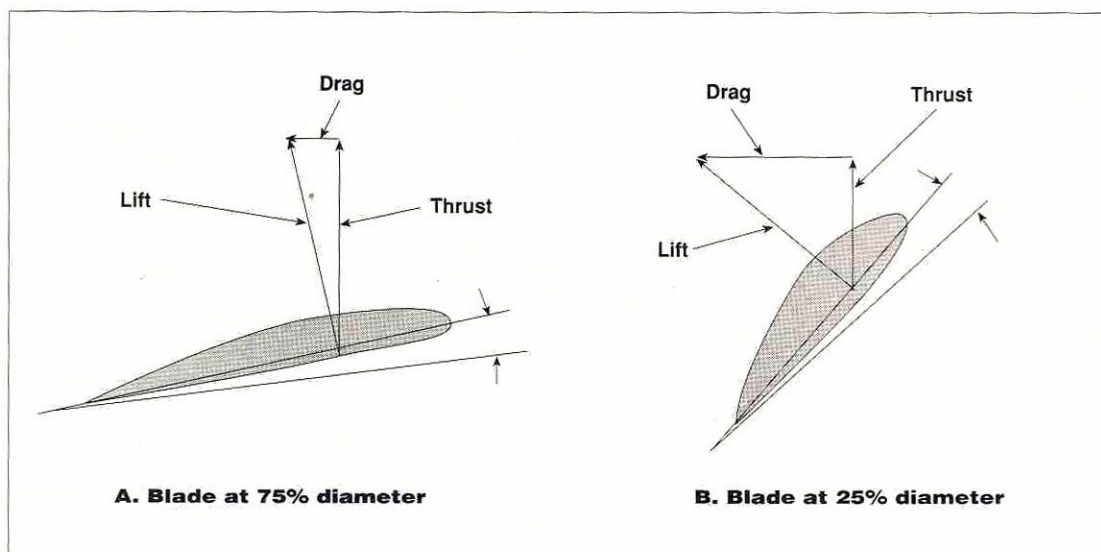
- The “true pitch” is the actual distance the prop advances per revolution. The difference between geometric and true pitch angles is the angle of attack at which the prop airfoil is truly operating and is called the propeller “slip.”

A heavy model with high air drag and in a steep climbing attitude will offer high resistance. Under these conditions, the propeller must operate at higher angles of attack or slip, with increased profile and induced drags. This reduces the engine’s rpm.

It should be noted that, while pitch is a major



**FIGURE 3. “Constant Pitch” Propeller**



**FIGURE 4. Lift, Drag and Thrust Vectors at 75% and 25% Diameters**

factor in speed, a plane obviously can’t fly faster in level flight than a speed that is close to that permitted by its geometric pitch multiplied by the rpm.

In a dive, with the engine at full rpm, the actual advance per revolution may increase to a point where the prop’s airfoil is operating at a very low or a negative angle of attack. The profile and induced drag reduce substantially, the prop “unloads” and the engine over-revs—which does it no good! Experienced fliers throttle back in dives for this reason.



# Propeller Selection

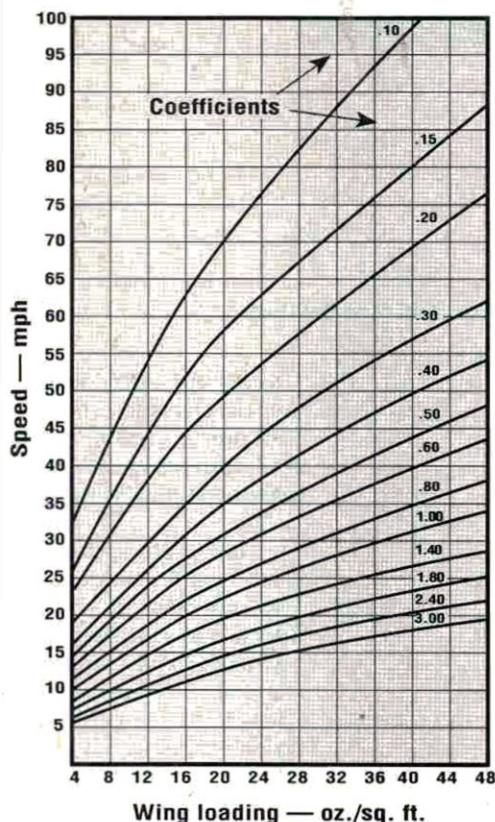
## CONSTANT PITCH PROPELLERS

Each point on a propeller blade—rotating and simultaneously advancing—describes a helix inside an imaginary cylinder. Consider one blade advancing one revolution; imagine cutting the cylinder lengthwise down one side, from start to finish of that one revolution. Imagine opening and flattening it.

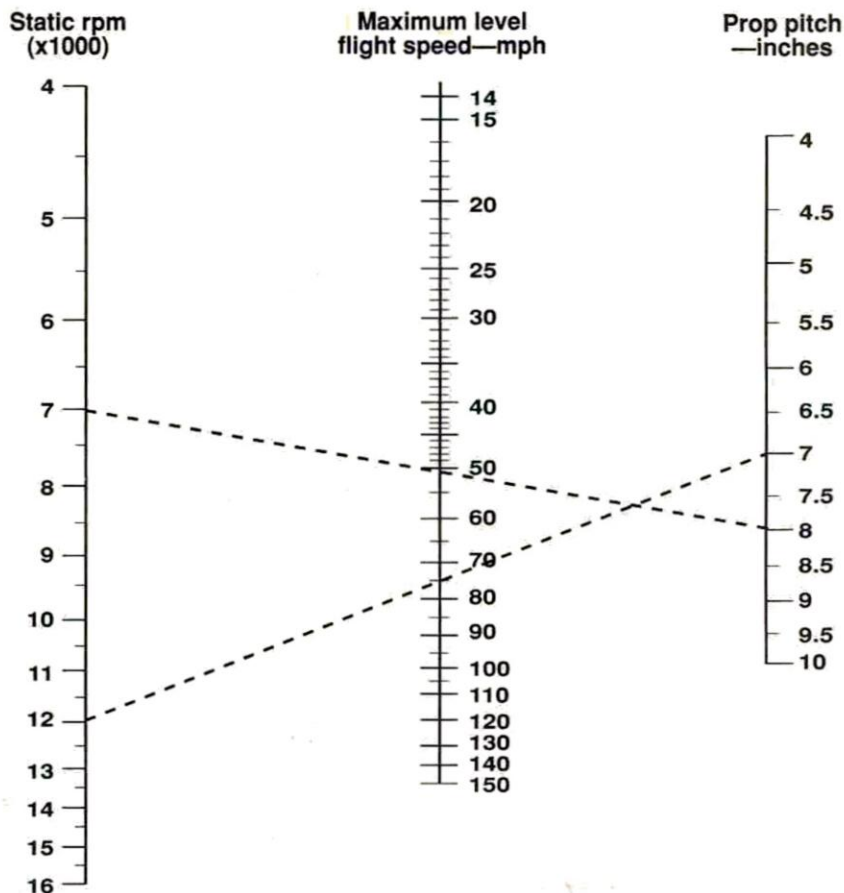
Figure 3 shows this flattened cylinder along with the geometric and actual pitches and blade cross sections at 100 percent, 75 percent, 50 percent and 25 percent of the blade's length (see also the diagram shown in *Airwaves*, page 8 of the August '92 issue of *Model Airplane News*).

Note how the geometric angle of the blade varies from tip to root so that there is a constant angle of attack. Calling such a prop "constant pitch" is a bit of a misnomer; the blade is obviously twisted. "Constant angle of attack" is more accurate.

To calculate the propeller's speed at any point along its length is easy. Take the prop tip



**FIGURE 5.**  
**Nomograph for Quick**  
**Determination of Wing**  
**Loading, Lift and Speed**



**FIGURE 6. Nomograph for Quick**  
**Determination of RPM, Pitch and Speed**

in Figure 3; in one revolution it moves from A to B; AB is the hypotenuse of a right-angle triangle. Recalling high school geometry: "the square of the hypotenuse of a right triangle is equal to the sum of the square of the other two sides." In formula form and Figure 3:

$$AB = \sqrt{AC^2 + BC^2}$$

A 12-inch-diameter prop, advancing 5 inches per revolution would have a hypotenuse of:

$$\sqrt{(12 \times 3.1416)^2 + 5^2}$$

or 38.02 inches.

Tip speed for this prop turning at 10,000 rpm would be

$$\frac{38.02 \text{ ins} \times 10,000 \text{ rpm} \times 60 \text{ mins./hr.}}{12 \text{ ins./ft.} \times 5280 \text{ ft./mile}} \\ = 360.12 \text{ mph}$$

At 50 percent of the blade length, the speed would be 50 percent of 360.12 mph or 180.06 mph. Those blades are lethal; take care!

Figure 4 shows blade cross sections at 75 percent (A) and 25 percent (B) of the blade length from the hub. Both are operating at the

same angle of attack. Note that at 25 percent, because of the blade angle, the lift is more inclined, the drag vector is increased and the thrust vector is reduced in comparison with the 75-percent point. This inner portion is less efficient, and from 25 percent to the prop center only worsens. A spinner of roughly 25 percent of the prop's diameter would cover this portion and would smooth out the airflow moving backward. For a 10-inch-diameter prop, a 2 1/2-inch-diameter spinner does just that.

In Figure 4B, the higher blade angle, reduced thrust and increased drag reflect the effect of higher pitches for the prop as a whole. The increased drag reduces engine rpm; lower diameters are indicated. The reverse is also true; lower pitches with larger diameters.

## THE AIRPLANE

The design of the model has a major bearing on selection of its propeller diameter and pitch. The factors are:

- The weight and wing loading
- The model's aerodynamic drag
- The weight-to-power ratio or power loading
- The type of performance desired.

**Weight and Wing Loading.** The heavier the model, for a given wing area, the higher its wing

(Continued on page 93)





**I**T ISN'T EASY making the transition from a sport plane to an aerobatic aircraft. The Hobbico® Starfire 40 makes it a snap. Almost ready to fly (ARF) airplanes have made huge inroads in the R/C model world in a relatively short time, often much to the chagrin of life-time hobbyists who take great pride in the building process. Pulling an 80-percent-complete kit out of a box offers no challenge to these old-timers, and they can't understand how anyone else could derive satisfaction from the experience either.

Clearly, there's a growing group of modelers who are interested in the sport primarily for the thrill and excitement of flight for flight's sake, not for the private enjoyment of shaping pieces of balsa by hand to make a craft that will remain airborne.

ARF advocates have good reasons to choose this type of aircraft. They may not yet have developed the building skills required to assemble a complete kit, but just as often, the ARF owner simply can't devote the amount of time that's required to build a complete kit.

## Instant acrobat



**HOBBICO**  
*Starfire*<sup>40</sup>

by EARL & BOB CARPENTER





This airplane was tested under a variety of conditions, ranging from zero wind to unbelievably strong 30mph gusts, on chilly days and in the baking, hot sun.

## Takeoff and landing

Let the Starfire 40 build up a head of steam before it lifts off. The trike rear tracks straight and true and is relatively unaffected by the torque of the engine.

Landings are clearly the Starfire's Achilles heel. Owing to the lack of built-in washout, they required higher speeds than you'd expect for a sport plane. The potential for wing tip-stalls increases as speed decreases.

The drill for successful landings involves speed and an easy glide path. Don't dive down at the runway and try a big billowing flare-out. Instead, ease the plane closer and closer to the runway while gradually backing out of the throttle. When the Starfire 40 is practically on the ground, chop the throttle. We don't want to make it sound as if every landing is a hair-raising encounter, but with a design like this, it's in this area that things will get dicey if you aren't careful.



## High-speed performance

Absolutely incredible. The Starfire 40 is nearly unparalleled when it's boring holes through the sky. We made virtually no trim changes when transferring from low or medium speeds to wide-open flight. Vertical performance is commendable, but the strength comes in easy maneuverability during all attitudes of flight. The Starfire 40 responds to the pilot's input with precision, yet it has a comforting tendency to not overreact.

## Low-speed performance

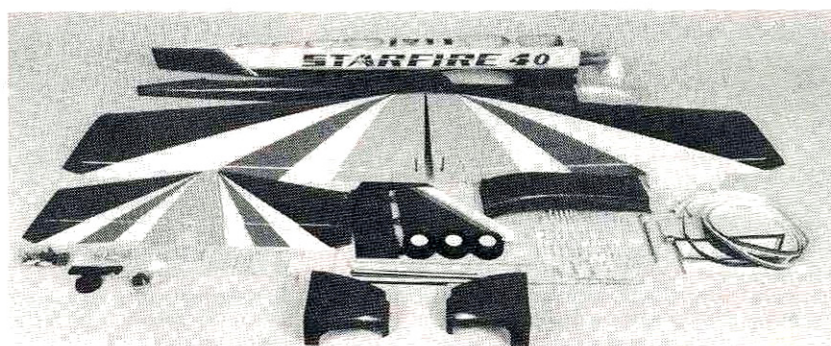
If you've read about the thrill of landing the Starfire 40, you've certainly already figured out that it isn't the most reassuring airplane at low speeds. The tip-stalling makes recovery difficult, even from what should be gentle stalls.

## Aerobatics

Absolutely, positively incredible. The sheeted wing, light weight and crisp controls contribute to the stunning aerobatic capabilities of this plane. Comparing it with anything short of a Nats-style pattern plane isn't much of a comparison. The Starfire 40 can do anything you ask of it.

The symmetrical airfoil accounts for a good deal of the hot performance, but the sheeted wing probably accounts for more. The sheeting makes the wing clean aerodynamically.

It doesn't take much aileron to get the plane to respond. We were so confident after a few outings with the Starfire 40 that we took a shot at flying it in a virtual windstorm. With 30mph winds blowing steadily, we launched the Hobbico airplane sideways across the runway and it was in the air after just a few feet. The resulting air show was one of the most enjoyable we've had with any airplane, anywhere. We were able to point the nose into the wind and do barrel roll after barrel roll without changing relative ground position. With slight throttle back we could virtually hold the plane in one place and, with a touch of up-elevator, watch it blow over in what must have been the world's largest and most elongated loop. Bizarre. Our landing was odd, too, as we put it down perpendicular to the actual runway. We didn't go off the opposite edge, either. We can't imagine trying that with many other airplanes. If you want to step up to a more responsive craft, the Starfire 40 is a great airplane that will lift your confidence. If you're already confident, you might find skills that you didn't know you had.



Hobbico's high-quality Starfire 40 kit contains wood that has been picked for its strength and lightness.

There's another important, sometimes overlooked, reason why a good percentage of ARF owners choose this route, and that's the outstanding flight characteristics that many of these planes have. Manufacturers have their pick of light wood and light designs, and if they pull together all the elements intelligently, they can produce a very light, clean design.

Hobbico has accomplished this with the Starfire 40, a truly aerobatic airplane designed for experienced pilots.

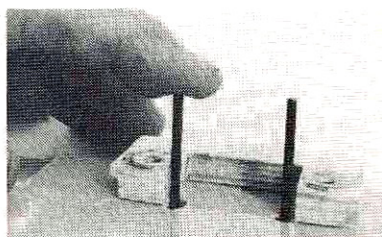
wing root, precisely on the leading edge of the wing, and then use a 7mm drill bit to bore a straight, true hole parallel to the wing root. Neophyte builders: you can't stall forever, so dive in. We



The fuselage is built-up in a box style with plywood doublers. We had to trim the wing-seating area a little to make the wing fit perfectly.

## CONSTRUCTION

Hobbico claims that the Starfire 40 is 80 percent complete out of the box with no sanding, painting, or finishing required. That's absolutely correct. You probably won't, however, be flying the Starfire 40 on the same day that you



The wing hold-down block was a little too snug to fit around the aileron controls, so we trimmed it. It's good to check the fit before you install the block in the fuselage (as shown).

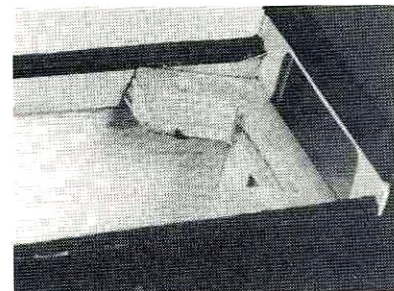
open the box. We spent about eight hours working on the plane from start to finish.

The construction manual devotes 17 pages to the final assembly of the Starfire 40 and lists a total of 93 steps (including radio and engine installation). The first two steps involve marking and drilling the leading edge for the installation of 7mm dowel rods to serve as wing locators. This can strike fear into a non-builder's heart. You're asked to make a mark exactly 1 inch from the

used a small center punch to ensure that the hole would be perfectly centered when drilled.

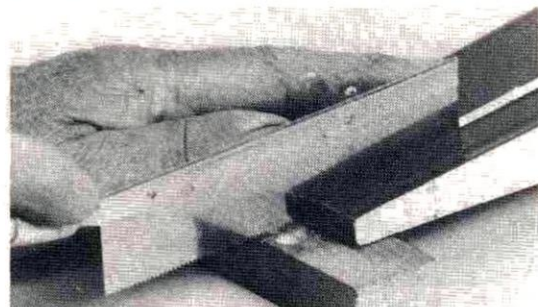
Long-time builders who have complete sets of drills in American sizes (but not a metric drill in sight) might be frustrated because they need 7mm drills. Don't fret; we've figured it out for you. We used a micrometer to check the size of the dowels in our kit and found them to be 0.280 inch in diameter. A  $\frac{9}{32}$ -inch drill bit is only 0.001 inch bigger, but first, we used a  $\frac{7}{64}$ -inch bit (0.262 inch) to drill a pilot hole.

Another tip is to start the first bit into the wood in reverse direction. This puts a good-size "countersink" exactly where you want it. The drill won't jump

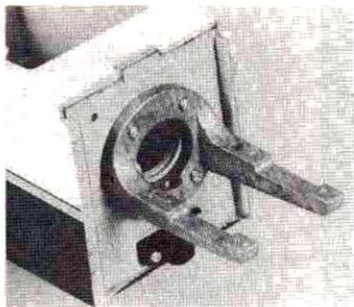


When the block is in place, there's an easy way to mark the locations of the bolt holes on the wing: install the bolts and dab some paint on them, then slide the wing into place. The paint will mark the proper location on the wing.





*The slot for the horizontal stabilizer must be finished off and a saw is the best way to ensure a straight cut.*



*Hobbico provides a high-quality motor mount that helps to anchor the tricycle gear.*

off-center when you start to drill.

Next, glue the two wing halves together (using the included tapered and angled wing joiner, which makes this critical task extremely simple).

Although the wing and ailerons have been slotted, you'll have to install the hinges yourself. Be careful not to get any glue on the hinge. Hobbico recommends that you put a dab of petroleum jelly on the hinge pin to protect it. We usually run toothpicks into the wing and through the holes on the hinge.

#### SPECIFICATIONS

**Model name:** Starfire 40  
**Manufacturer:** Hobbico  
**Type:** Sport/pattern  
**Sug. price:** \$164.99  
**Wingspan:** 56 inches  
**Wing area:** 546 square inches  
**Wing loading:** 23.2 ounces/square foot  
**Weight:** 5.5 pounds  
**Length:** 47 inches  
**No. of channels req'd:** 4 (rudder, elevator, aileron, throttle)  
**Power req'd:** .40 to .45 2-stroke; .60 to .80 4-stroke  
**Engine used:** O.S. .46 2-stroke  
**Airfoil type:** Fully symmetrical, sheeted wing  
**Wing construction:** Spruce spar and built-up balsa  
**Kit construction:** Built-up ply and balsa, 80 percent built  
**Washout:** None

**Features:** kit includes tank, wheels, landing gear, hinges, spinner, pushrods, clevises, horns and construction manual with photo illustrations.

#### Hits:

- Outstanding high- and medium-speed flier
- Extremely good aerobatic ability
- Easy to assemble

#### Misses:

- Low-speed flight less responsive
- Lack of washout leads to tip-stalling (especially during landings)

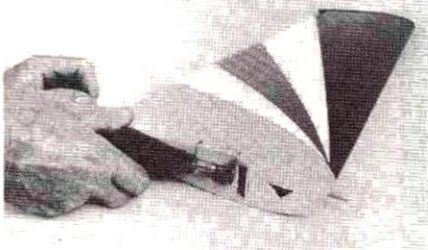
Because the Starfire's slots are somewhat oversize, we think that this is definitely a good idea.

When it's time to glue the wing-mounting blocks into the fuselage (step 17), we suggest that you test-fit the piece on the bottom of the wing and make sure it fits around the aileron control arms. (Ours required some trimming.)

You must also drill two  $\frac{3}{16}$ -inch holes in the wing. The easiest way to mark the hole locations is to put the wing screws into the blocks with about  $\frac{3}{8}$  inch protruding and dab some paint on the heads. Slip the wing into position, and the paint will mark the hole location for you.

After we had drilled it, we noticed that our wing didn't fit all the way down into the fuselage. This isn't something that you should let slide if yours exhibits a similar condition. It will affect the wing incidence. The fuselage wing saddle can easily be trimmed for a proper fit.

The wing-mounted landing gear is easy to attach—trim the covering away from the slots, slip in the gear and mount two plastic retaining straps with self-tapping screws—but the setup is weak. We examined the construction after a slightly rough landing (honest) ripped the gear from the wing. The problem? The mounting block is attached to two ribs. That's it. To give the block more to grab and to strengthen the two ribs, we glued balsa tri-stock along the length of the two ribs while we made repairs. If we ever have a problem with the other side, we'll modify it this way, too. We recommend that



*The builder must cut out some of the balsa at the root of the wing to make room for the aileron servo. Absolute beginners might be nervous about cutting, but this is truly a minor operation.*

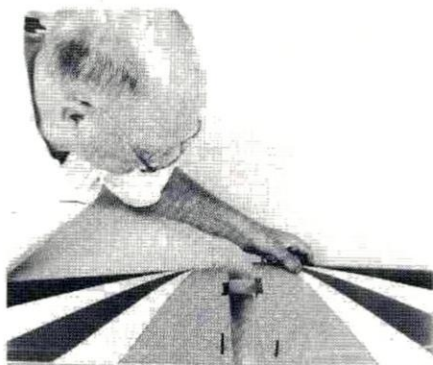
you consider doing the same.

The front strut of the tricycle landing gear is a snap to install, but pay close attention to the angle at which you drill the hole in the fuselage for the control rod. If the angle isn't shallow enough, the control rod won't line up correctly with the bellcrank on the strut. You don't want to discover this after you've already applied glue to the control-rod tubing. The engine and radio installation are straightforward and pose no problems.

Assembling the elevator and the rudder pushrods requires some thought. You must bend the wire rods and slot and drill the wooden dowels. Clearly, this isn't a monumental task for an experienced builder, but it will take non-builders some time. We suggest that you use a pin vise to hand-drill the holes in the wooden rods and then use the drill to carve out the grooves.

#### TAIL PLANE

Assembling the tail feathers is about as easy as you can expect. The construction manual cautions you to ensure that the horizontal stabilizer is parallel to the wing. If it isn't, you'll have to sand the higher side of the stab mount. You also must ensure that the stab is centered and square.



*After the servo has been properly fitted, trial-fit the two wings together using the angled, tapered wing joiner; it's critical that the fit is perfect. Gluing, of course, is even more critical.*

The kit includes a number of plastic parts, e.g., wing tips, horizontal stabilizer tips, rudder tips, a turtle deck and a cowl. The pieces might seem a little flimsy, but they've held up well.

When we hooked up the control rods to the horns, we discovered that the clevis pins weren't long enough for the width of the control horns. To solve this problem, we sanded the control horns to make them thinner.

Hobbico recommends that you balance the plane at a point  $\frac{4}{4}$  to  $\frac{4}{2}$  inches from the leading edge of the wing, next to the fuselage. After we had installed the muffler and the prop, our plane balanced perfectly. Hobbico recommends that you set the sur-

(Continued on page 93)



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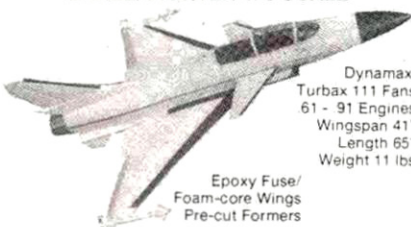
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### VT-240

(Continued from page 19)

throttle. A slightly moist, pale golden brown appearance of plug element and body will indicate approximately correct fuel setting; dryness and/or paler color would show danger signs of over-leanness. If you have any doubt during the first half an hour of running-in, it's wiser to keep both fuel needles at an obviously too-rich setting—in which case Enya's claimed fuel consumption of 60cc/min. will very likely prove accurate!

In all cases, note that (owing to non-linear-ity of fuel flow with rpm in suction carbs) the heavier the load and, therefore, the lower the rpm at full throttle, the greater the relative opening of the main fuel needle required. This is due to the lowering of air velocity through the carburetor and consequent reduced suction. When using the largest propellers then, it may be necessary to shut the throttle somewhat just to keep the airflow at sufficient value to draw enough fuel.

### SUMMARY

Enya's adoption of the V-Twin layout for this large-scale engine gives modelers as compact, light and rigid a power unit for the developed horsepower as is reasonable to expect at this stage of normally aspirated model engine development.

(Continued on page 72)





by TIM DIPERI

CAPSTONE R/C

# Ultimate KAOS.60

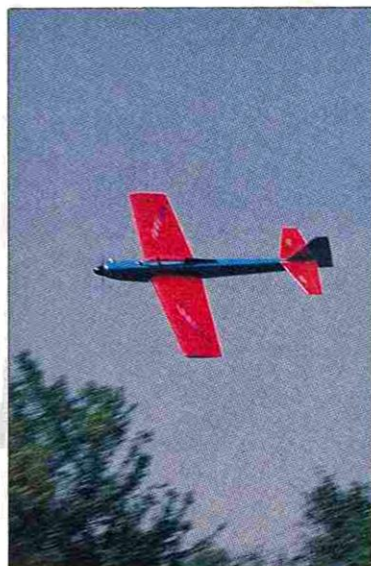
## SPECIFICATIONS

**Model name:** Ultimate Kaos .60  
**Manufacturer:** Capstone R/C  
**Type:** Pattern trainer/sport  
**Wingspan:** 62<sup>3</sup>/<sub>8</sub> inches  
**Wing area:** 692 square inches  
**Weight:** 7 pounds  
**Wing Loading:** 23.3 ounces per square foot  
**Length:** 48<sup>1</sup>/<sub>2</sub> inches  
**Engine used:** .45 to .61 2-stroke (O.S./Performance Specialists .61)  
**Retail price:** \$109.95  
**No. of channels req'd:** 4 (aileron, elevator, throttle and rudder)  
**Radio:** 4-channel (Futaba 7 UHP was used in review)

**Features:** fully symmetrical wing; all-wood, built-up construction; carbon-fiber spar overlay material for added strength; vacu-formed canopy, full-size plans; machine-cut plywood parts; engine mount and assorted hardware.

### Hits:

- Good performer
- Forgiving and very stable
- Good value
- Built to be strong and durable



PHOTOS BY RON FARNAS

### Misses:

- Instructions lacked photographs, and procedures could be clearer.
- Some of the balsa wood was very hard.
- In the review kit, some of the parts were missing, or they were the wrong size.

## Newest version of a classic

I HAD MY first opportunity to fly an original Kaos .60 in 1977. This airplane (then kitted by Bridi Enterprises) became one of the most recognized pattern training airplanes of the time. Capstone's\* Ultimate Kaos is a derivative of the earlier Kaos and Super Kaos airplanes.

### THE KIT

The well-packaged kit contains just about everything you'll need for this built-up wooden airplane. Most of the parts are made of hard, dense balsa stock, and there are several packages of machine-cut plywood and accessories.

[Editor's note: Dennis Dean of Capstone notes that: (1) the review kit was from a pilot run of 50 kits, and that the parts problem has been corrected in subsequent runs. Dennis invites any purchaser to call Capstone at (800) 593-5250 if there are any kit questions; if a part is defective, a replacement will be shipped at no cost; (2) the stab is internally braced with triangle stock, and a hardwood beam runs the length of the rear fin to join to the fuselage, obviating the need for the external triangle strips noted in the review.]

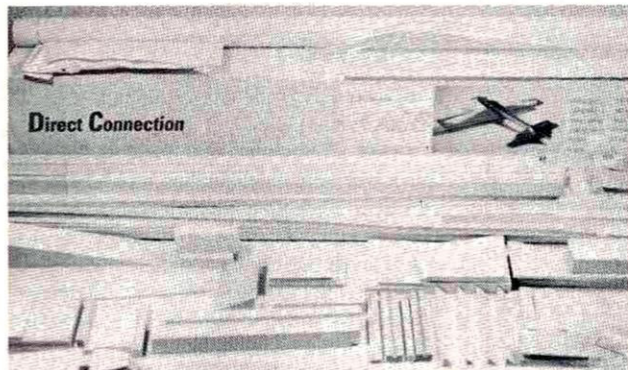


The kit also includes a vacu-formed plastic canopy and a full-size set of fairly well-detailed prints for the fuselage and the wing. The assembly guide would be more effective if it included drawings and photos.

### CONSTRUCTION

The box-type fuselage has two sides, a top and a bottom. Each fuselage side consists of two pieces that must be joined at the wing saddle. A joining doubler is then glued to the inside of each.

Most of the bulkheads are made of rectangle stock cut to length. On top of the fuse-



The kit with its well-packaged parts.

## KAOS .60

lage sides, triangle stock is used so that the sides and top blend in during sanding.

The Ultimate Kaos uses either a tricycle landing gear or a conventional gear. I chose the former and also decided to use a Kraft Midwest\* electric retractable landing gear. I had to cut the bulkhead in front of the wing and

install a flat fuel tank so that the nose gear could retract.

The empennage is built with balsa rectangle stock, which creates a strong tail section. Unfortunately, the trailing edge for the empennage was too short, so I replaced it with a larger piece.

After securing the empennage and the vertical fin to the fuselage, I decided to add 1/4-inch triangle stock to all the attachment points around the tail. Although this wasn't

## FLIGHT PERFORMANCE

*Before installing the engine in the model, I broke-in the engine with 15-percent nitro fuel. I also flight-tested it with both 15-percent nitro and 30-percent special helicopter fuel. The special heli fuel provides some extra power, but because of its high oil content, there was a lot of smoke in the exhaust.*

### • Takeoff and Landing

Takeoffs are similar to those of a trainer. At full throttle and with a little elevator back pressure, the airplane is airborne without even the slightest wing wobble. I was impressed with the O.S./Performance Specialist .61 engine. Only a touch of right rudder was needed to compensate for torque, "P" factor, etc. As far as ground handling was concerned, even with retracts, the airplane behaved quite well. Again, landing the Kaos is predictable and should pose no problems for those who have some experience. It's almost too easy to put this airplane on the runway. Just throttle it back, trim in some up-elevator to slow it down, and the airplane descends nicely. The flare can be held for some time without the wings rocking.

### • High-Speed Performance

After trimming out the airplane (which took about two clicks of down-elevator trim), I flew some low passes, and I did a few high split S's at full throttle. There were no indications of flutter, and the airplane tracked smoothly.

### • Low-Speed Performance

The Ultimate Kaos is designed as a first sport pattern airplane. One thing that you won't have to worry about is stalling this airplane without warning. I deliberately made some slow, nose-high turns from the base leg to final approach just to feel it out. No problems. The airplane penetrates well, but it will float a bit near the ground. Even when the airplane is slowed down to a stall speed, it just lowers its nose and regains flying speed (if you release the elevator, of course). I noticed no unusual snapping stalls at all.

### • Aerobatics

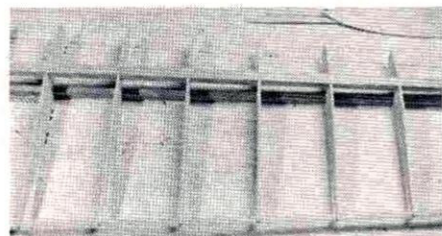
This airplane was definitely made for aerobatics. Loops were effortless with only a slight amount of wing leveling needed for the crosswind. Outside loops were as clean as inside loops. I never ran out of down-elevator control. I also tried some full-deflection loops in order to force a high-speed stall, but I was unsuccessful.

Knife-edge flight requires all of the available rudder to keep the airplane from losing altitude. With my .61, the Kaos couldn't climb while in knife-edge.

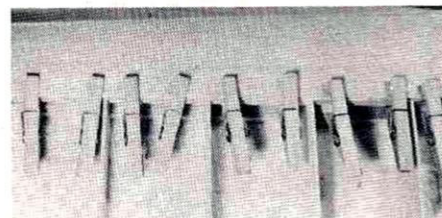
Axial rolls were straight as an arrow. In fact, during a pass, with just a touch of a nose-up attitude, I cranked the ailerons and rolled the plane over with no down-elevator while inverted. There was no noticeable altitude lost.

I found that the airplane rolls positively and, when the control is neutralized, the airplane stops its rotation with no noticeable over travel. Sustained inverted flying requires about one-eighth down-elevator. Again, the airplane behaves very well during inverted flight.

In short, the Ultimate Kaos is extremely forgiving, and aerobatics can be performed easily. My friend and photographer Ron Farkas traded his camera for the transmitter, and he put the airplane through a few more aerobatics. Ron also thought that this airplane would be a good choice for a first-time pattern airplane.



Framing up the wing over the plans.



After the wing halves have been joined and the carbon-fiber material has been added to the top and bottom spars, the top sheeting should be clamped to the main spar.

part of the kit, it made me feel better.

Finally, I used a Hayes\* engine mount, although the one included in the kit will work fine. After I attached the nose-gear retract mount and the Hayes engine mount to the firewall, I epoxied the firewall to the fuselage sides. I used a rebuilt O.S.\* 61 that has a Performance Specialties\* ABC piston and sleeve and a standard O.S. muffler.

### THE WING

The built-up wing is fully symmetrical, partially sheeted and double-tapered. According to the instructions, there's supposed to be a wing jig included, but I was unable to find the metal rods, so I decided to "wing it"



2 METER

**WINDSURFER**

Wing Span: 78 1/2 in. Length: 42 1/2 in.  
Wing Area: 544 sq. in. Airfoil: Flat Bottom Highlift

**WINDSURFER 100**

Wing Span: 98 1/2 in. Length: 45 in.  
Wing Area: 790 sq. in. Airfoil: Modified 205

**EZ-1 GLIDERS**

Wing Span: 78 1/4 in. Est. Flying Wt.: 26 ounces  
Wing Area: 544 sq. in. Airfoil: Modified 205

**EZ-2 "100"**

A larger version of the EZ-1, easy building with turbulator spars, an open class glider that can perform with the best of them. Plug-in wings for easy transportation. Stress for high starts.

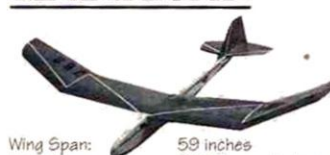
Wing Span: 98 1/2 in. Est. Flying Wt.: 45 ounces  
Wing Area: 790 sq. in. Airfoil: Modified 205

**TERCEL****GRENADE-LAUNCHED**

Wing Span: 50 1/2 in. Flying Weight: 11 1/2 ounces  
Wing Area: 275 sq. in. Airfoil: Modified 205  
Length: 31 1/4 in.

**FLIPPER**

Wing Span: 50 1/4 in. Est. Flying Wt.: 11 1/2 ounces  
Wing Area: 270 sq. in. Airfoil: Modified 205

**KASTAWAY**

Wing Span: 59 inches  
Wing Area: 380 square inches  
Est. Flying Weight: 15 ounces  
Airfoil: Modified 205



**BRIDI AIRCRAFT DESIGNS, INC**  
23625 Pineforest Lane  
Harbor City, California 90710

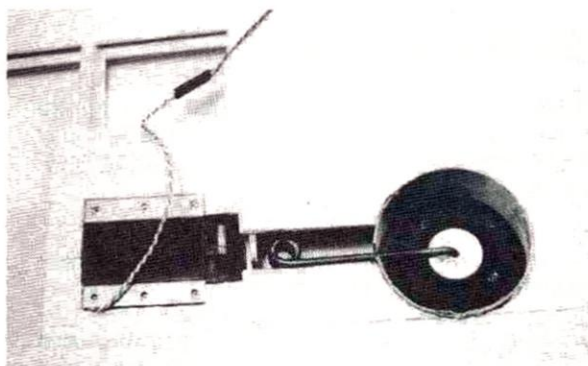
(213) 326-5013 549-8264

**KAOS .60**

without a jig. (I did check another kit, and the rods were there.)

I laid out the plans and decided to secure the lower spar to the plans and attach the ribs at a 90-degree angle to the work surface. It looked good, but many of the ribs didn't meet the trailing edge. The manufacturer told me that some of the ribs in the earlier kits were the wrong size, but that they could be replaced upon request.

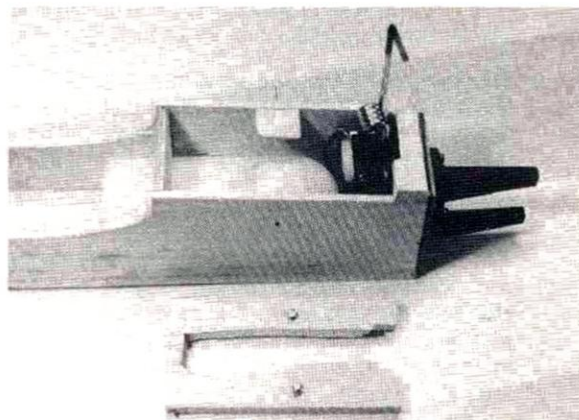
The Ultimate Kaos uses carbon fiber (approximately 15 inches long) on the cen-



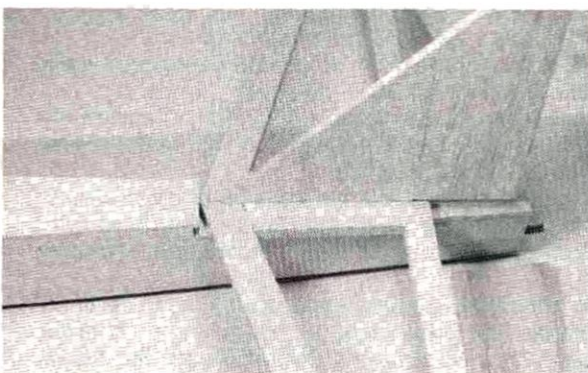
The bottom of the wing with the gear retracted. The wheel well is made out of a cardboard container.

ters of the upper and lower spars. The carbon fiber strengthens the wing and must be added after the wing halves have been joined but before the wing is sheeted. After I framed each wing panel, I installed the retractable main gear. The cutouts for the retracts weren't in the ribs, so the ribs have to be cut out regardless of which landing-gear configuration you choose.

Because I chose retractable landing gear, I used balsa sheeting to enclose the strut



The nose-gear retract unit and hatch. Notice the low-profile tank and the double firewall.



The stab is internally braced with triangle stock, and a hardwood beam braces the rear fin against the fuselage.

area and an empty cardboard can for the wheel well. The can's diameter fit the 2 1/2-inch-diameter wheels with room to spare and, since the can was made of cardboard, I had no problem gluing it to the wood. I sealed the wheel well with K&B\* epoxy paint. I also painted the tank compartment and canopy outline with black K&B paint, and I covered the entire plane with MonoKote\* and Sig\* iron-on covering.

I also chose a Futaba\* 1024 7-channel heli radio with S5101 and S9101 servos. There's a lot of room in this airplane, but it fills up quickly when you install retractable landing gear.

The Ultimate Kaos is a reasonably priced, predictable pattern airplane that performs very well. The instructions and the plans, however, could be improved. This airplane would also do quite well as a low-wing trainer. Whatever your choice, the Ultimate Kaos .60 won't disappoint you.

Here are the addresses of the companies mentioned in the article:

**Capstone R/C Supply Inc.**, 562 Schrock Rd., Westerville, OH 43081.

**Kraft Midwest Inc.**, 115 East Main, Northville, MI 48167.

**Hayes Products**, 14325 Commerce Dr., Garden Grove, CA 92643.

**O.S.**; distributed by Great Planes Model Distributors, P.O. Box 9021, Champaign, IL 61826.

**Performance Specialties**, P.O. Box 3146, Gardnerville, NV 89410.

**K&B Mfg. Inc.**, 2100 College Dr., Lake Havasu City, AZ 86403.

**MonoKote**; distributed by Great Planes Model Distributors.

**Sig Mfg. Co.**, 401 S. Front St., Montezuma, IA 50171.

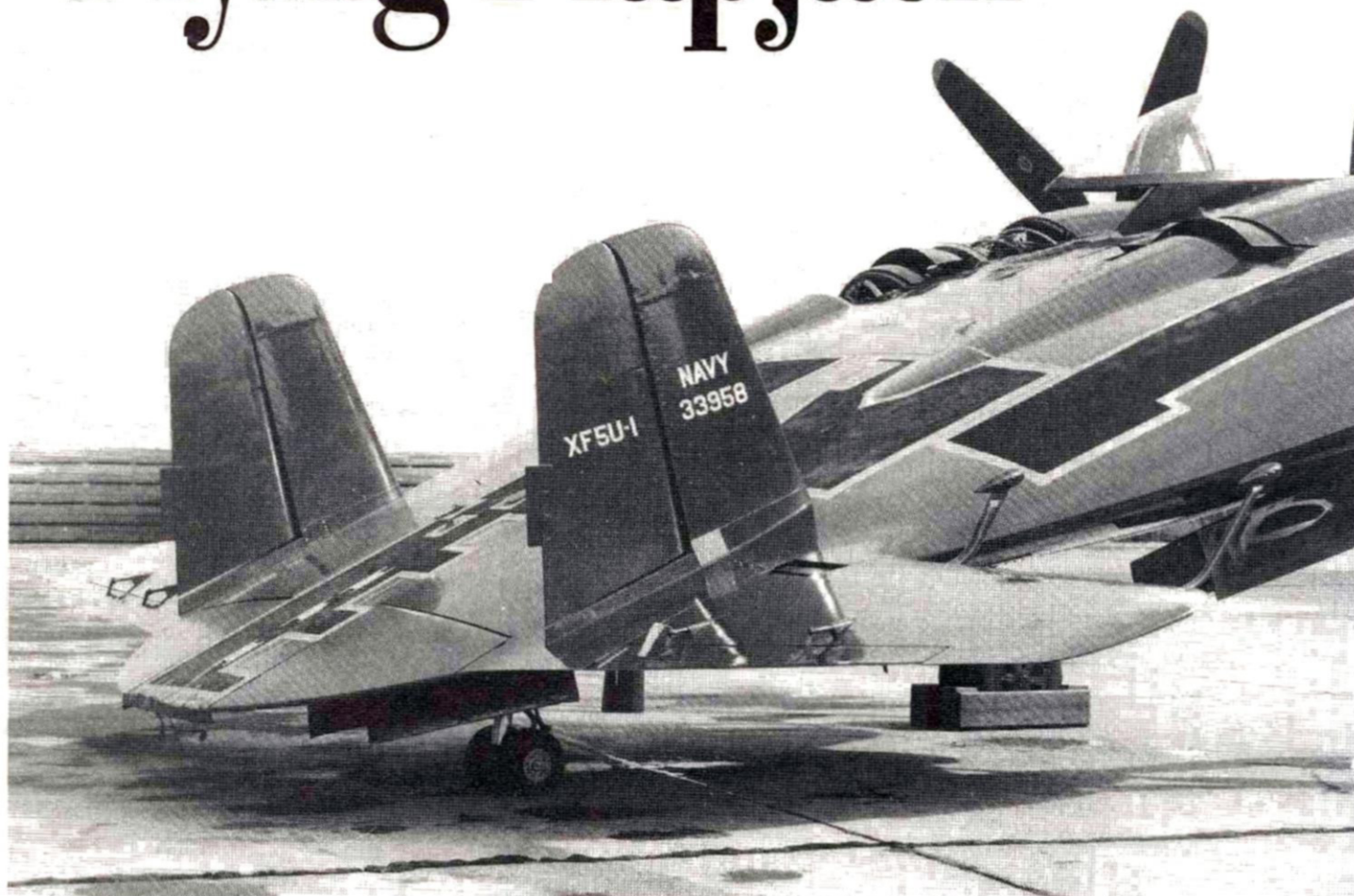
**Futaba Corp. of America**, 4 Studebaker, Irvine, CA 92718. ■



by FRANK GUDAITIS

*LESS THAN 30 years after the Wright brothers flew at Kitty Hawk, a brilliant young engineer conceived an original design for a very unorthodox airplane. Its unique feature was its capability to fly at speeds ranging from less than 20mph to well over 400mph!*

# Flying Flapjack



He was Charles Horton Zimmerman, a farm boy from Olathe, KS, who earned an engineering degree by working his way through school. Like so many young men of his generation, his thoughts soon turned to the then evolving field of aeronautics. Consequently, he applied for and was offered a position with the Langley Research

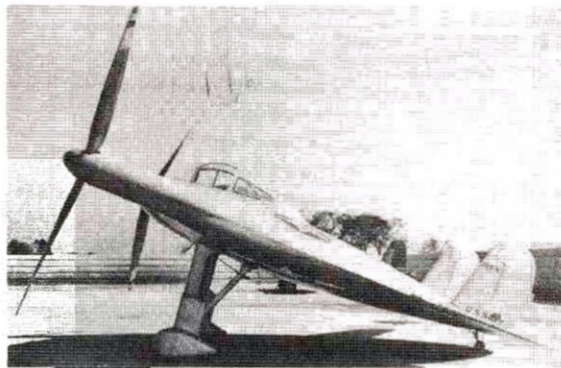
**DID THE  
MILITARY  
TURN ITS BACK  
ON A SAFER  
WAY?**

Center of the National Advisory Committee for Aeronautics, the predecessor of today's NASA.

There his inventive mind turned to finding ways to make flying safer. The result of his efforts was a wing design with an aspect ratio of 1.27:1; in effect, a slightly elongated circle. This low-aspect-ratio design was radically different from the high-aspect-ratio wing designs of nearly all other fixed-wing aircraft of the time, and this difference is just as pronounced today.



Far right: designer Charles H. Zimmerman circa November 1949 (photo courtesy of NASA). Right: the Chance Vought V-173 "Zimmer's Skimmer," as it was affectionately dubbed, sits at a high angle of attack on the ground. Below: the V-173 during one of its many successful flight tests.



following year, his invention and services as the chief development engineer were acquired by the Chance Vought division of the United Aircraft Corporation.

Very soon thereafter, the U.S. Navy recognized the remarkable potential of his invention and funded the development and construction of a full-size prototype. This aircraft became the V-173, a relatively lightweight flying wing powered by two air-cooled 80hp Continental engines. In accordance with Mr. Zimmerman's discoveries, the airflow from the two large propellers, which were mounted on both extreme ends of the wing, satisfactorily eliminated the wing-tip vortices and turbulence that results in a loss of lift on conventional wings.

**The significant difference between Charles Zimmerman's design and all "conventional" airplanes is the safety factor inherent in very slow, controllable flight.**

In November 1942, the V-173 completed its ground-taxi tests and was flown for the first time by test pilot Boone Guyton. While he encountered very high forces on the control movements, Guyton did find the flight "one of the most interesting in his career as a professional pilot." The 13-minute first flight ended uneventfully with a touchdown at under 50mph and a landing roll of no more than 50 feet!

The V-173 was subsequently flown for a total of 131 hours. In addition to Mr. Guyton, another Chance Vought test pilot, Richard Burroughs, and a number of Navy pilots flew this radical airplane. Even the legendary lone eagle Charles Lindbergh was sufficiently fascinated by it to want to take it aloft.

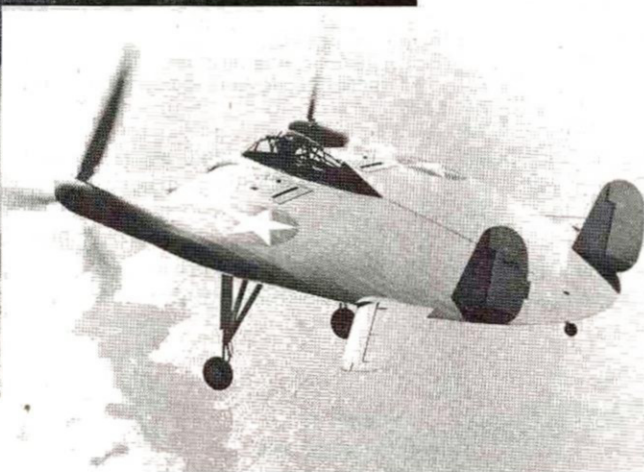
With the success of the V-173 flight tests, design work on the XF5U-1 Navy fighter was started in 1943. It was configured in the same planform as the V-173. The principal differences between the prototype and the fighter were in the weight and the engine power. The V-173 weighed slightly over 3,000 pounds. The XF5U-1 weighed more

than five times as much. The fighter was powered by two Pratt & Whitney R-2000-7 air-cooled radial engines, and each developed 1,350hp at 2,700rpm.

Though the V-173 was constructed basically of wood with fabric covering, the technique for building the XF5U-1 was again years ahead of its time. The external construction of this aircraft

The significant difference between Charles Zimmerman's design and all "conventional" airplanes is the safety factor inherent in very slow, controllable flight. Think of all the aircraft disasters that could have been prevented if the ill-fated flying machines had been capable of such controllable slow flight.

Zimmerman applied for a patent on his invention in April, 1935. Three years later, he was granted U.S. patent no. 2,108,093. The

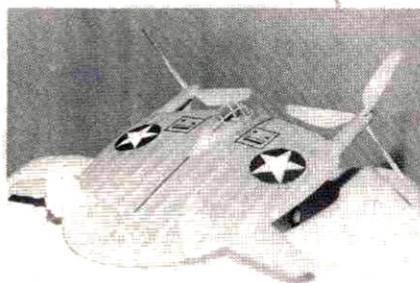




# Flying Flapjack

was made of a composite material developed by Chance Vought called "metalite." It consisted of aluminum sheets bonded to a core of balsa wood. Does it sound familiar today?

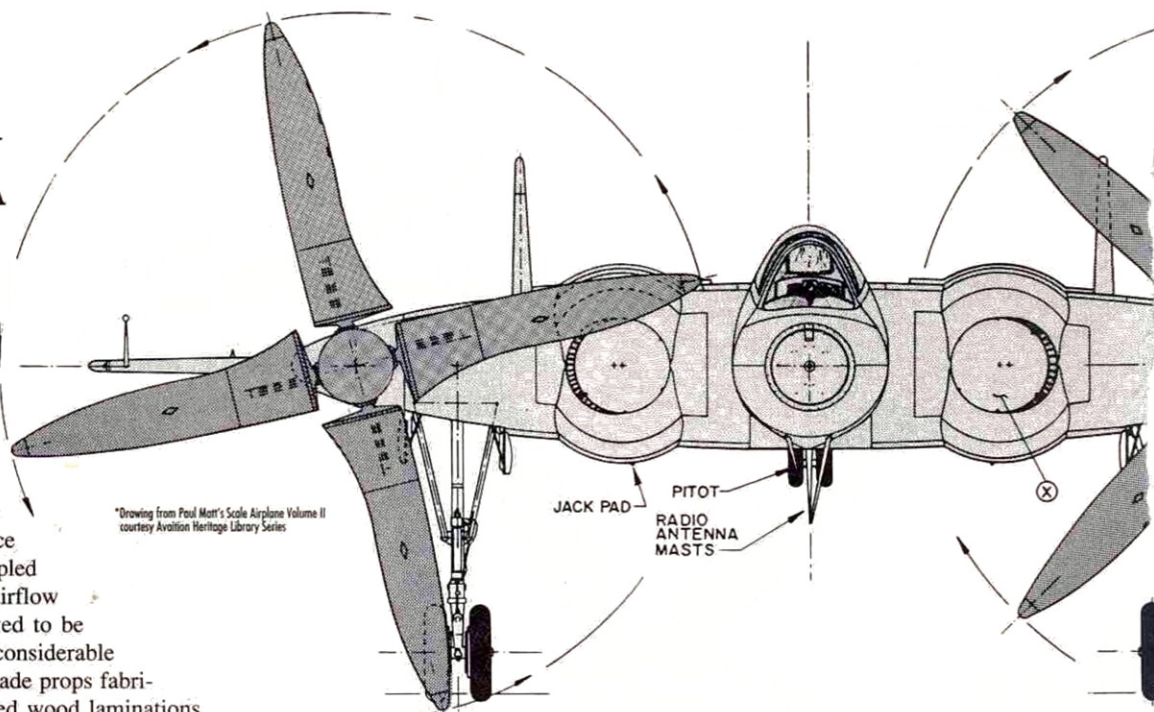
At first, four-blade Hamilton Standard propellers of the type found on the Chance Vought F4U Corsair were coupled to the engines. The resultant airflow over the wing surfaces proved to be totally unsatisfactory. With considerable design effort, special four-blade props fabricated of Formica-impregnated wood laminations were made by the same supplier. These 16-foot-diameter props had blades that were articulated much like helicopter rotors. They were also "synchro-phased," i.e., each blade of both counter-rotating props was matched in relation to the position of the mating blade on the opposite propeller.



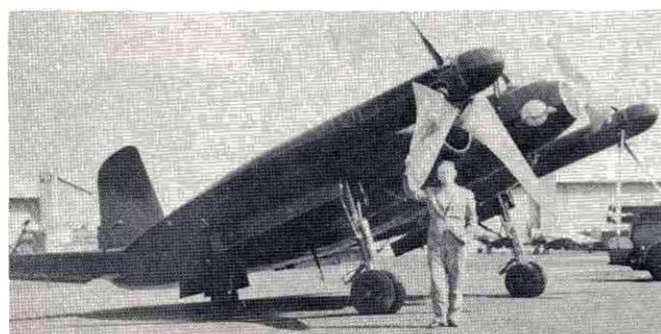
*This rubber-powered Peanut-scale model of the V-173 has logged many successful flights.*

The very wide blade root was employed to reduce vibration and to absorb heavy loads encountered while flying at high angles of attack.

The gear drives that coupled these counter-rotating props to the two inboard engines were designed so that in the event of an engine



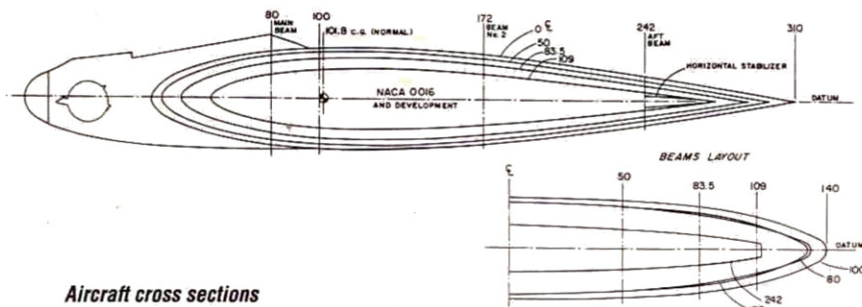
failure, the remaining engine would then drive both props. The XF5U-1 was designed to carry bombs or belly tanks on pylons under the wing. Its armament consisted of six 20mm cannons. The top speed was calculated to be around 500mph with a range of approximately 1,000 miles. Incredible as it may seem, this extraordinary aircraft, which had so much potential, was never given a chance to fly! By March 1948, Chance Vought had made arrangements to ship this airplane to Edwards Air Force Base in California for flight testing. The Navy then decided that it no longer needed prop-driven fighters now that jets were capable of operating from carriers. In what was certainly one of the great blunders in aviation history, the Navy ordered Chance Vought to destroy this remarkable aircraft!



*Charles Zimmerman and Vought XF5U-1. Note Zimmerman holding the specially built, Formica-impregnated prop blade.*

failure, the remaining engine would then drive both props.

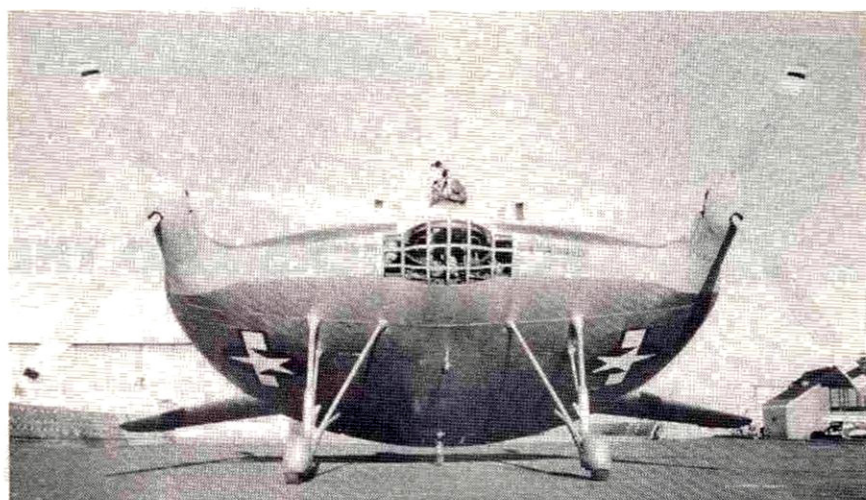
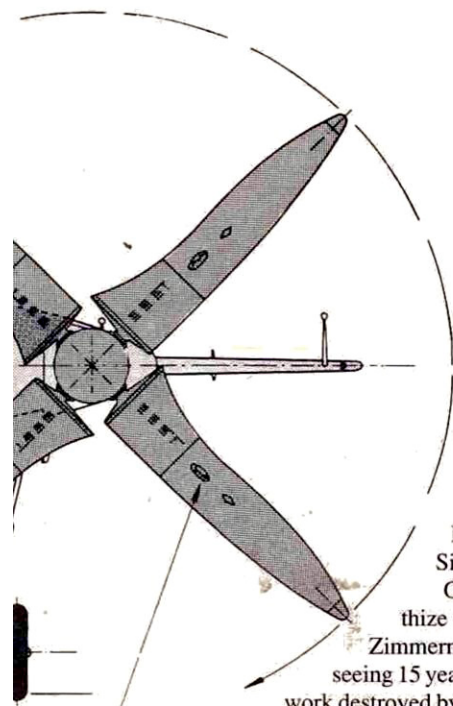
Fortunately, the V-173 was spared such a fate and today, it still exists in the Smithsonian's National Air and Space



**Aircraft cross sections**

*\*Drawing from Paul Matt's Scale Airplane Volume II courtesy Aviation Heritage Library Series*





Front view of the V-173 shows the necessary underbelly glass-work. Early plans also existed to study the advantages, if any, of piloting in the prone position.

Museum facility at Silver Hill, MD.

One can only empathize with what Charles Zimmerman must have felt seeing 15 years of his pioneering work destroyed by a wrecking crew's steel ball. The real tragedy however, is in the realization that more than four decades ago, he offered the science of flight a new form of safe aerial transportation. The "powers that be" ignored his invention until very recently when VTOL was "re-discovered" by the aviation industry.

Charles Zimmerman subsequently returned to his work as an engineer and scientist at the Langley Research Center in Virginia. There, he continued to pursue innovative aeronautical developments. One of many was his vector flight principle, which was applied to a unique

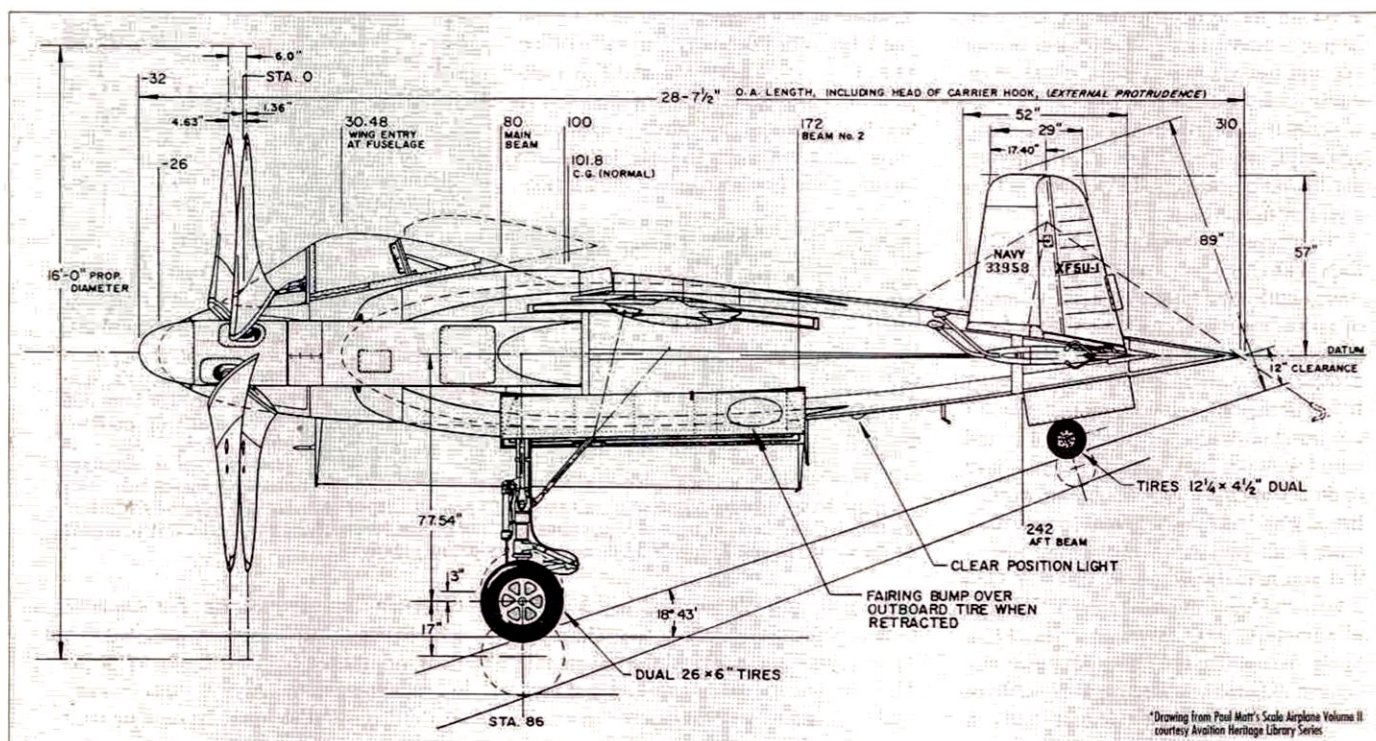
**The realization that more than four decades ago, he offered the science of flight a new form of safe aerial transportation. The "powers that be" ignored his invention until very recently when VTOL was "re-discovered" by the aviation industry.**

helicopter that was designed and manufactured by the DeLackner Company. (See "Heli-Vector" in the October '90 issue of *Model Airplane News*.)

In recognition of his lifetime of achievements, he was elected a Fellow of the American Institute of Aeronautics and Astronautics, and he was also awarded the Wright Brothers Medal.

Several years ago, a model builder on the West Coast constructed a peanut-scale flying model of the V-173. It would seem that both the V-173 and the XF5U-1 would make excellent R/C models. It's this writer's wish that perhaps this brief article will kindle a spark of enthusiasm along these lines to some of you R/C builders out there.

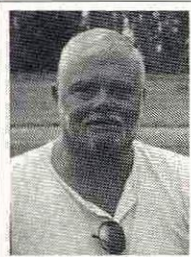
\*Aviation Heritage Library Series, P.O. Box, 2065 Terre Haute, IN 47802. ■



\*Drawing from Paul Matt's Scale Airplane Volume II courtesy Aviation Heritage Library Series

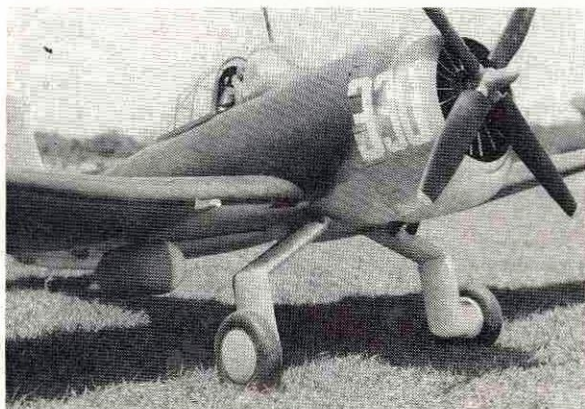


# SPORTY SCALE TECHNIQUES



FRANK TIANO

## SCALE PICKS AND THE BGX-1



*Dick Graham's Curtiss Seahawk spans 96 inches and weighs 28 pounds. An A&M 3.2 provides plenty of poke. The Seahawk will graduate to floats once he's comfortable with the flying characteristics of the wheeled version. The shock-absorbing landing gear can be removed by loosening just three bolts.*

AFTER SEEING THE '91 coverage of Top Gun put together by Major Tom and his merry band of artists, I truly thought that it would be difficult to duplicate that piece of work. Well, after seeing the Major's latest effort, I guess I was all wet. Top Gun '92, as depicted in our very own pages, is undoubtedly the best coverage yet and has generated more phone calls than ever from all sorts of modelers worldwide who want information on everything and anything, from travel information to the invitation process. Now, let's get on with this month's stuff.

To receive an invitation to '93 Top Gun Expert Division, you must be a competent scale builder and pilot; you must be recognized by your peers; and you must have had some degree of success, at some scale contest, somewhere during the past year. If you fit the bill, and your airplanes aren't constructed with a hammer, rake and chisel, you just may qualify. All you have to do is send me a picture of your work, a list of your local and national conquests, a letter from your AMA district rep stating that you're really deserving of a Top Gun invite, and leave the rest to the T.G. board of directors. The same goes for Team Scale, except that only the pilot needs any contest experience, whether it be scale or pattern. And he must be able to fly and talk

to the judges at the same time. The builder needn't be a national hero—just an above-average modeler. Invitations go out next month, so if you'd like to nominate someone, perhaps even yourself, now is the time to do it.

Once again, Top Gun will be held at the Palm Beach Polo and Country Club in West Palm Beach, FL. The dates are April 29 through May 2. Stay tuned in to *Model Airplane News* during the next few months for all the skinny on where to stay, how to

get there and who's gonna be competing.

Sometimes I overlook some outstanding models that are literally under my very nose. The very new 1/3-scale Extra 300 offered by Model Aviation Technology\* is one such case. This absolutely gorgeous machine is distributed right here in Florida just a few miles from my Zap sales office. M.A.T.'s version of the famed 300 is a specialized, custom kit featuring a perfect fiberglass fuselage and cowl, pre-sheeted wings, stab, rudder and a scale, heavy-duty landing gear. I've seen one of the first kits,

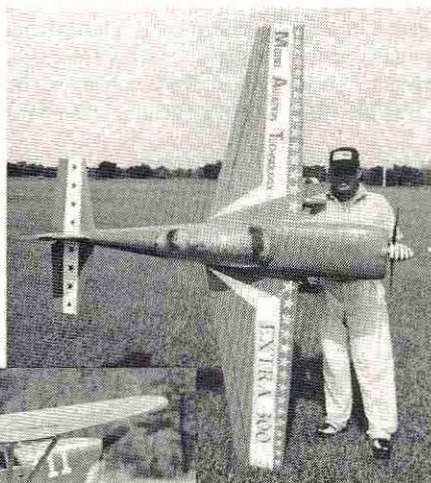


*1/3-scale beauty has a 93-inch span and weighs 21 pounds. Above right: Roy Vaillancourt's 102-inch Stinson L-5 Sentinel (covered in Super Coverite\* and finished with latex paint) looks very authentic on the damp runway. A Quadra 35 powered the 19-pound prototype.*

and I gotta tell ya that Tom and Marilyn Gruenebaum have done a first-class job. They've thought of everything imaginable. The wheel pants, the spinner and that beautiful big canopy are nice touches as are the

custom, protective wing covers. George Jenkins did a fabulous job with the 38-page instruction manual. One of these 300s will compete at the Tournament of Champions in Las Vegas this fall. If any bad news could be attached to this fabulous airplane, it would have to be that it's a limited-production kit. The price?—just a wee bit heavy: \$1,600! For those of you who just have to have one, remember to get your order in early because Christmas is just around the corner!

Another neat airplane you may want to consider for next year's competition is Roy Vaillancourt's lovely Stinson L-5 Sentinel. Roy offers this airplane in either kit form or a plan package with a fiberglass cowl and a specially welded landing gear. In any event, the ship is a real stunner, and the



*Above right: Model Aviation Technology's limited-production Extra 300 is available by reservation only and is handcrafted in Germany exclusively for MAT. This*

color schemes are plentiful. For someone who wants to get started in scale but is a little intimidated by the complexity or extra detailing required to do a "heavy metal" warbird, the Sentinel may be right up their

*(Continued on page 68)*



proverbial alley! For a look at what else Vailly Aviation\* offers, send for one of Roy's catalogues. (They only cost one buck.)

### MYSTERY MOTOR

This month, we address the question asked by several of you concerning the almost-new O.S.\* BGX-1 35cc engine. Seems that other authors have written conflicting information relative to this engine's performance, and I'm here to tell you of my experiences. First, let me say that the absolute perfect prop for this engine is an 18x8 by Dynathrust\* or a Zinger\*. Second choice would be an 18x6-10 and third choice would be an 18x10. In a lightly loaded, high-wing airplane like a big Cub, a 20x6 will perform satisfactorily. However, with an 18x8, here's what I observed. After one hour of break-in, I checked the max revs with an open exhaust and the carb restrictor in place. It turned up 8,600rpm and idled at 3,000. Next, I added the stock muffler and removed the carb restrictor, which produced 8,000rpm on top and a 2,000 idle. Next, I removed the muffler baffle and checked the rpm with a Zinger 18x8, which equalled 8,300. A Dynathrust 18x8 did 8,800 in the same configuration. I then checked the two props for trueness of pitch and found the Dynathrust to be exactly 8 inches and the Zinger a bit more. Both idled at 1,800. Changing to a J-Tec\* BGX-B muffler with dual exhausts showed no changes, but going to a J-Tec Snuffler muffler robbed 700rpm from top end. Art Johnson flies the BGX in his P-35 with an 18x10 with no problems. I think it runs a lot better and cooler with 2 inches less pitch. Will the BGX out-turn a Webra Bully? Close, but no! But, Bullies are no longer available, and this Hobbico\* Slugger is sure to be the next best thing!

### COLOR ME CORRECT

I received a letter from one of our readers who questioned the accuracy of the color chips found in some of the Monogram books and the M&M book distributed through FTE\*. The bottom line was that this gent thought the faded, worn-looking chips in the book certainly didn't match any of the colors displayed in various publications of restored warbirds or any of the color photos taken during World War II that he has seen.

Allow me to explain. First of all, pho-



*These are just a fraction of the real silver cups and awards presented by Model Airplane News, Pacer and FTE at Top Gun. Sam Wright, the "voice of Top Gun" has Frankie T. step up to the mike while Joe Manzella looks on.*

tography was in its infancy during World War II and from what I've read, the color accuracy in these photos isn't to be trusted. Second, while many colors left the factory in brilliant shades of red, blue and yellow, these paints weren't the sophisticated enamels, lacquers and epoxies of today, and it took just a matter of days, not years, to start the weathering process that we've all come to know and love. For example, United States Insignia Red was a rather bright red that faded to a dull reddish-brown after about 150 hours of exposure to the sun's highly damaging ultraviolet rays. Same goes for all other colors. Olives and greens faded really fast and so did the oranges, browns and yellows. Only the colors used on the undersides of the aircraft were able to withstand the weathering effect because of their protected location. To show how poor paints of that era really were, take a good look at some pictures of the highly weathered Japanese aircraft or some of our own naval aircraft taken late in the war. Most of that dappling effect you see isn't a deliberate attempt at some sort of experimental or novel camouflage but a direct result of the poor-quality paint losing its adhesion with the poorly prepared metal undersurfaces! In other words, the bloody paint is peeling off right before your very eyes! So you see, when the Chicago Scale Masters, Claude

McCullough and David Platt took all that time to duplicate WW II color chips, they spent a lot of time researching what the respective colors looked like in the field, not what they looked like as they rolled off the assembly line. In other words, the chips are correct!

Before closing this month, I'd like to thank all of you who have inquired about my new Bearcat landing gear and Bulldog retracts. We have something new this month: a scale, retractable tail-wheel/tire assembly for the Bearcat and other 1/5-scale Navy aircraft like the Corsair, and an all-metal, dual-spoiled, sequencing air valve to replace the plastic, prone-to-leaking type now being used. The tail-wheel retract is \$140, and the air valve is \$38 and guaranteed not to leak. My last word of caution: to those of you who have installed a Greek sandwich in the belly of your aircraft in an effort to straighten your errant takeoff rolls, this isn't the type of gyro we were talking about! Until next month, check your six.



*Art Johnson relies on the O.S. BGX-1 35cc (2.2ci) engine for spirited performance in his 26-pound P-35. The model is completely covered in aluminum sheet! No, there's no radio interference with today's modern radios!*

\*Here are the addresses of the companies mentioned in this article:

Model Aviation Technology, 12848 Touchstone Pl., Palm Beach Gardens, FL 33418.

Vailly Aviation, 18 Oakdale Ave., Farmingdale, NY 11738.

O.S./Great Planes Model Distributors, P.O. Box 9021, Champaign, IL 61826.

Dynathrust Props, 2541 Northeast 11th Ct., Pompano Beach, FL 33062.

Zinger; distributed by J & Z Products, 25029 S. Vermont Ave., Harbor City, CA 90710.

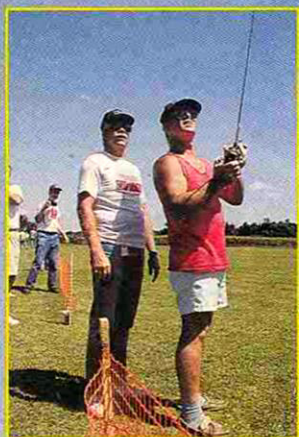
J-Tec, 164 School St., Daly City, CA 94014.

Hobbico/Great Planes Model Distributors.

FTE, Frank Tiano Enterprises, 15300 Estancia Ln., W. Palm Beach, FL 33414.

Coverite, 420 Babylon Rd., Horsham, PA 19044. ■





Nick Sr. concentrates on flying as Bob Stettes keeps an eye on traffic.



# Annual Giant-Scale Warbird Fe

## TIME WARP TO WW II

by GERRY YARRISH

**T**HE 1992 WW II Giant Scale Warbird Festival at Lums Pond State Park, Bear, DE, took place on August 1 and 2. Now in its fifth year, this annual event—the brain child of Roy Vaillancourt and Bruce Kane—was hosted by the Delaware Gypsy Giants of Wilmington and



Tim DeLong of Bath, PA, flew this 101-inch-wingspan Zirol design Ju-87 Stuka dive bomber. It's powered by a G-62, and took only four months to build.



One of the nicest P-40s was this Byron kit built by Bill Jameson. Sachs 4.2 under the cowl.



Corsair alley: the F4Us were well represented.



The crosswind took its toll on a few pilots, but most planes were easily repaired. (Number 765 wasn't quite that lucky!)



Bill Steffes modified a Zirol AT-6 Texan to produce this fixed-gear BT-14 variant.





Ron Chizek of Johnstown, NY, flew this impressive, 144-inch C-47. Built from Zirolli plans, the Gooney bird is powered by two Quadra 35s and weighs 45 pounds.



AT-6 Texan lineup was impressive and shows how popular the advanced trainer is.

# stival

sponsored by Miniature Warbirds Limited. The Warbird Festival is a no-pressure, time-to-show-off event for all scale, IMAA-legal, military aircraft produced between 1935 and 1950. The models, which

include fighters, bombers, recons and transports, must be painted in their original military colors. Civilian and Civil Air Patrol versions and disguised sport models aren't eligible. (Continued on page 75)



Reminiscent of Oshkosh, a squadron of Texans prepares to fly in formation.



Left: Co-founder of the Giant Scale Warbird Festival Roy Vaillancourt gets into the spirit of the meet with his "uniform of the day."



Left: with the local C.A.P. in charge of car and ground logistics, parking was no problem.



Rare, striking MiG-3 built by Ron Gagner of North Oxford, MA was flown by Tim Haggerty. The scratch-built model is powered by a G-62.



Nick Zirolli's big Beech D-18 wowed the crowd all weekend. With its thick smoke trails, it was very realistic.

PHOTOS BY CHRIS CHIANI & GERRY YARRISH



## BALL BEARING SERVO CONVERSION KITS

With LDM Industries' new Ball Bearing Servo Conversion Kit you can convert your standard servos to ball bearing servos in just minutes. The Futaba and Airtronics kits includes 4 new servo top cases, each containing a high quality stainless steel ball bearing for the servo output shaft. The remaining kit includes 4 ball bearings which replace the plastic bushings that come installed in the servos. LDM Industries' new Ball Bearing Servo Conversion Kit will:

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## VT-240

(Continued from page 54)

For a 4-stroke twin, it's also commendably uncomplicated in structure, and the manufacturer's conservative performance claims appear to indicate yet again a degree of laid-back confidence in the inherent quality of their current productions. Performance was consistent at all rpm points and satisfyingly lively, and at the end of test, there were no signs of any mechanical problems. ■

## CENTER ON LIFT

(Continued from page 22)

Another choice is to be efficient in higher-speed flight. To do this, the predicted CG will be moved rearward. If you go too far, you'll have elevator sensitivity control problems. The best choice depends on the task you fly. A variable CG might be worth the effort for cross-country flying, which requires a combination of thermaling and high-speed flight.

## SPREADSHEET FOR FINDING THE CG

I put together a spreadsheet to calculate all the necessary values and produce a chart of CG positions. (If you're interested in obtaining the spreadsheet, send me an SASE.) The first step is to enter the wing geometry. The wing chords, sweep of the wing and wingspan at the breaks in the wing must be entered. From these values, the wing MAC is calculated.

The next step is to enter  $C_{mo}$ . The spreadsheet generates CG positions for different lift coefficients. Check a reference such as *Soartech 8* to determine the maximum lift coefficient for the airfoil, and use a value lower than the maximum. When you want to determine CG for higher-speed flight, compute the lift coefficient required for that speed flight. This gives you a potential CG location, but you might have elevator sensitivity problems, especially for high-camber airfoils. For airfoils like the SD8000 and RG15, you can go all the way down to 0.6 or 0.5 without too many problems.

## AIRFOIL CHOICE

What about the choice of airfoil for a design? Your airfoil selection also affects the range over which you might move the CG. Airfoils with a higher  $C_{mo}$  will have a greater range of CG locations. This means as you deviate from the optimum CG,  $C_l$  combination for these airfoils, a greater drag penalty exists than an airfoil with a low  $C_{mo}$ . The sailplanes with better all-around performance have airfoils that have a low  $C_{mo}$  such as the E205 and SD8000. On the other hand, designs with airfoils like the S4061 and E214 have problems with penetration on windy days unless you can change the camber.

I hope you enjoyed the discussion. If you have any questions on soaring or sailplanes,

(Continued on page 89)

Germany's Seidel Radial Engines have set the standard for the serious European modeler and collector. Now available in the U.S., Seidel is redefining the way people view this classic design.

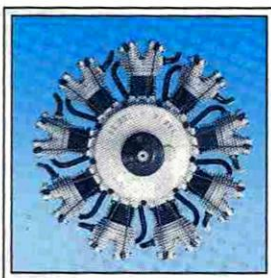
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# Straight-winged Jets

**T**WO DUCTED FANS that found their way to the Festival were the Bob Violett Models\* (BVM) T-33 and Nick Zirolis' new all-wood Grumman F9F-2 Panther. Both jets qualified for the event by just making the cut-off date of 1950. Powered by O.S. .91 engines, both had re-tractable landing gear, flaps and scale air inlets, and neither had any trouble flying off the grass field.

Nick offers plans for his Panther, and there will soon be a kit available from Chuck Gill at the Aeroplane Works\*. The Panther is built in the traditional Zirolis fashion: all wood, with bulkheads, stringers and balsa sheeting. Inside, there's plenty of room to mount any engine and fan combination. The prototype uses a Dynamax fan unit.

(see "Air Scoop" for more information).

Dave Malchione of Kenneth Square, PA, flew his



*With flaps and retracts extended, the Panther had a very short roll-out after landings. The model tops out at about 115mph.*



*Down and dirty, the T-33 comes in for a landing.*

BVM T-33. When you see this model up close, you understand why it's of Top Gun caliber. Its detailing and workmanship are simply fantastic, and with its 80-inch wing-span, wing-tip tanks and Day-Glo orange trim, in flight, it's a treat to watch. It's smooth, precise and fast enough to make things really interesting.

Estimates say that both models flew at between 110 and 125mph, and both looked right on for scale speed. These two designs are great examples of straight-wing jets.



*As if on rails, the Zirolis F9F-2 Grumman Panther makes a high-speed flyby.*



*The Bob Violett Models 80-inch-span T-33 is legal for IMAA events. Dave Malchione flew well and had no problems flying off grass.*

*\*For more information, contact Bob Violett Models, 1373 Citrus Rd., Winter Springs, FL 32708. Nick Zirolis Models, 29 Edgar Dr., Smithtown, NY 11787. Aeroplane Works, 2134 Gilbridge Rd., Martinsville, NJ 08836.*

(Continued from page 71)

The meet is unusual because it's held each year at a different site. Lums Pond State Park, the home field for the Delaware Gypsy Giants, was perfect for this year's gathering: its 900x150-foot grass runway and five flight stations easily handled the air traffic. Joe Asher (president of the host club) CD'd the event and, along with Kerry Stanley (club VP), did the festival proud. The pits were large and well-organized, and the flight line was run with military efficiency. Safety had the highest priority, and everyone can be commended for a job well done.

Close to 150 top-quality models and 104 registered pilots took center stage for this time-warp trip back to the days of the last World War. With the Delaware CAP in charge of parking and ground logistics, the announcers (staff of Miniature Warbird Ltd.) and other ground personnel wearing khaki WW II uniforms and that big-band sound coming over the PA system, the illusion was complete. And special effects like the sounds of machine-gun fire and dropping bombs kept the crowd's attention. Truly, the pilots who

## Warbird Festival

showcased their models informed and entertained the public.

### THE EVENT

The event's most striking feature was the diversity of aircraft. From the round-engine trainers used in the early days of the WW II to the straight-wing jets deployed in the skies over Korea, every type of classic war machine was represented.

On Saturday, a 30-degree crosswind





# Warbird Festival

tested the pilots' skills and made for exciting flying. A number of landings were dicey, to say the least, and a few pilots decided to deliberately nose-over their models rather than having them tangle with the safety net.

Sunday's weather was picture perfect with light winds going straight down the center line. The flight direction was



*John Baldwin of Virginia Beach, VA, flew this great-looking P-47 Thunderbolt, which was built from a Nosen kit. It has a Quadra engine and a beautiful aluminum finish.*

reversed at about midday, but all flights were right on the numbers. Some models *did* crash because of radio problems or mechanical failures, but this—as the announcer reminded us—is the price of admission. Everyone there had a positive, forthright attitude, and not a single sour grape was peeled.

## THE PILOTS

The show was attended by some very well-known scale modelers, including Nick Zirola Sr., Dave Malchione (7th place, 1992 Top Gun Team scale winner) and Bill Steffes (Best in Military 1991 Top Gun). It's obvious that we saw some topnotch piloting. (Most were long-time, mature modelers whose average age was somewhere around 40.) There were many opportunities for modelers to confer with the designers of their models, and that added to an already splendid meet.

## THE MODELS

The two most popular types were the AT-6 Texan and the F4U Corsair, and these were either scratch-built from Zirola plans or from Byron Original kits (mostly the former). Also helping to defend the Delaware skies against the Axis powers was an impressive contingent of P-51 Mustangs and P-47 Thunderbolts.

More unusual models included Japanese Zeros, German Stuka dive bombers and a white MiG-3, which was modeled by Ron Gagner of North Oxford, MA. This beautiful, 1/4-scale, 101-inch-wingspan model was expertly piloted by Tim Haggerty, and the G-62-powered Soviet fighter did some of the lowest flybys ever.

To me, the most unusual model was a beautiful, 1/5-scale, 1939 Stinson O-49 observation plane, which was scratch-built by Wayne Eister of Danville, PA. The 9-foot-wingspan model was powered by a Zenoah G-38 and was finished with Coverite and silver Randolph dope. It took 14 months to complete and has fully operational flaps and articulated leading-edge slots. Built using

a crutch construction, the model was beautifully detailed and, weighing 25 pounds, it flew very slowly.

## HIGHLIGHTS

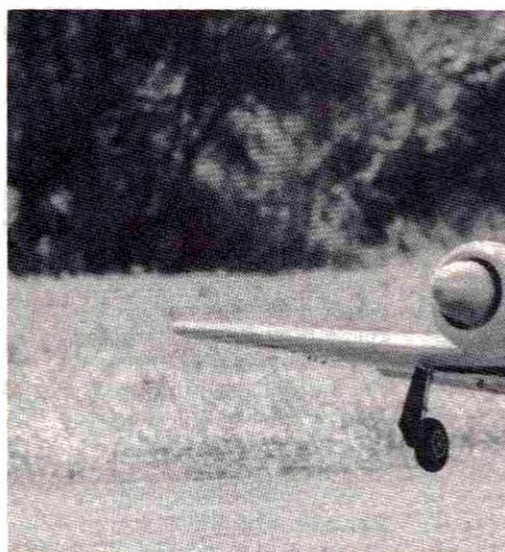
There were many!—a model AT-6 Texan



*Left: probably half of all the models were designed by this man—the granddaddy of giant scale—Nick Zirola Sr.*

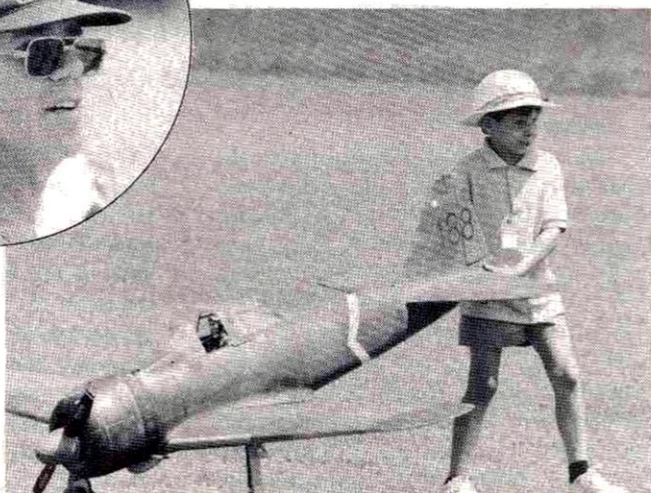
squadron of seven flew in formation (six were Zirola designs; one was a Byron Originals kit). The sight and sound of this was reminiscent of Oshkosh!

The next heart stop-



pers were formation flights by two 114-inch-wingspan Beech D-18s, one built by designer Nick Zirola Sr. and the other flown by Ray Suder of Penndel, PA. While the two big, beautiful twins flew together—huge loops and some beautiful, if not scale, rolls—all other action stopped. On a separate flight, after a very slow, low pass, Nick's D-18 landed with one engine out. In his attempt to wow the crowd, Nick had hit the smoke switch, and the fluid had killed one of the throttled-backed Zenoahs. Neither the model nor the pilot was hurt.

Twins were there in number, and Ron Chizek, flying his Zirola-designed C-47, was a real showstopper. This 45-pound monster has a 140-inch wingspan and is powered by two Quadra 35s. Its flying was



*A contrast in sizes, this line chief expertly handles the ground position of this Zero for public viewing.*





On final, Roy Vaillancourt's Hawker Sea Fury is about to touch down. Late on Saturday, the model was lost because an elevator servo failed.

fabulous; one almost expected a dozen scale paratroopers to jump out.

And that leads me to John Julian's Robbe R/C parachutist, Charlie, which jumped twice out of a Piper L-4. One of these was tragic, because the chute failed to open and many swore that they heard a small-scale "Eeeaaahhh"! Charlie *did* live to jump again, but John had a hard time convincing him to get back into the jump plane.

Finally, spectators (approximately 2,000 over both days) were overwhelmed when they were allowed to approach a lineup of all the model warbirds for a close-up look. Seldom do we see such an array of scale warbirds assembled in one place—a scale showcase, to be sure.

Sunday also had a full-scale treat: two full-size PT-19s flew several formation fly-by, and as if that wasn't enough, they were followed by a very grand Navy SNJ.

The festival was an uncontested success—ask those who stayed for Saturday's 400 pounds of barbecued pig and more than 500 ears of corn! Once again, we proved that when modelers get together, they don't have to compete to have fun. With a lot of flying, beautiful weather and some of the best scale models anywhere, the 5th Annual Giant-Scale Warbird Festival takes its place in the history books as the best one yet. I can hardly wait for next year's. If you missed this one and want to attend next year, it will be held in Schenectady, NY. For more information, contact Miniature Warbirds Ltd., c/o Roy Vaillancourt, 18 Oakdale Ave., Farmingville, NY 11738. See you there!

## JUST HOW RUSTY WILL YOUR FLYING BE NEXT SPRING?

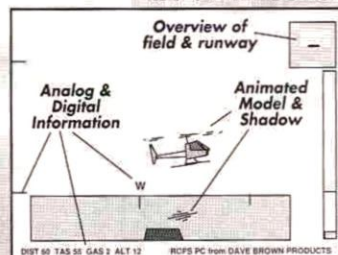
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# HOW TO

## PART I

# Covering R/C Airplanes

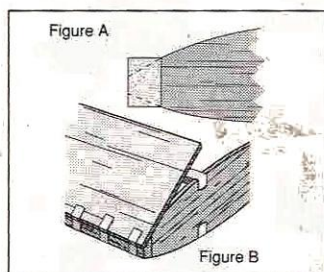
## Surface Preparation

by FAYE STILLEY

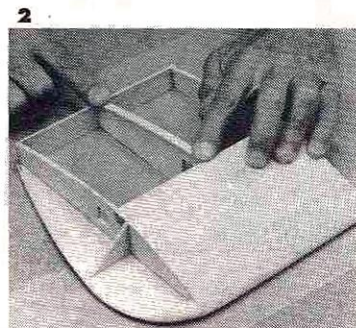
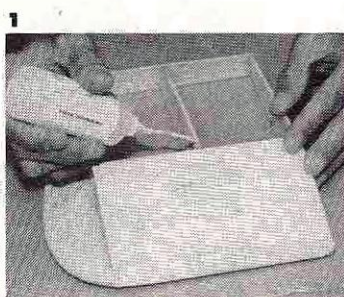


Faye Stilley in his workshop with a recent project.

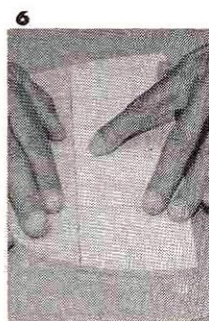
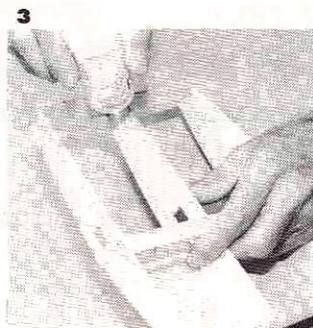
PHOTOS BY TOM ATWOOD



● **Figure A:** Shape the top and bottom of the leading-edge stock to a flat surface that continues the forward contour of the rib top and bottom. **Figure B:** Tape the sheeting as tightly as possible to the flattened stock, and glue it to the spar from the back. ● **1:** Apply glue to each end of the rib.



● **2:** Hold the capstrip at each end until it sets. ● **3:** Use thin CA on the underside of the capstrip.



● **4:** When applying CA to a wing-tip block, allow about 1/4 inch clearance around the outside edge. ● **5:** When you butt together two pieces of balsa, run a small bead of glue down the center of the edges. ● **6:** Carefully butt the pieces together on a piece of wax paper, and hold the pieces until the glue sets.

[Editor's note: this is the first in a four-part series on covering R/C airplanes by master coverer Faye Stilley, eight-time award winner at Toledo (including first place, MonoKote 1990 and 1991), and six-time award winner at the WRAM show. This series has been excerpted from a new Air Age title—"Covering R/C Airplanes, Basics and Beyond." That work goes into considerably greater detail, as noted in the Buyers' Mart. See page 127.]

**I**F YOU PLAN to use a heat-sensitive plastic covering on your model, the first thing to consider is the surface over which it will be stretched. Unlike paint, which is much more forgiving because fillers and multiple coats hide imperfections on the surface, plastic film shows virtually every rough spot. Film isn't much thicker than a fancy paint job, and there are advantages to using it. It weighs less and isn't as messy as paint, and even a beginner can achieve results that look better than most paint jobs. The best surface to use for covering is plain, smooth wood. Even the slightest bit of glue on the wood will grab the film, and cause high spots, low spots and pulls.

**TO SEAL OR NOT TO SEAL**  
Film covering should be stretched tautly over the wood, but not heat-sealed to it. This

will help eliminate bubbling and wrinkling. Except for where two pieces of film join along a seam, there's no reason to seal the covering to the wood.

I know of only one manufacturer that strongly recommends sealing the covering to every square inch of exposed wood on the airframe. The directions for Oracover\* instruct the user to iron the covering onto all of the airframe to gain structural strength. It seems logical that this film/wood laminate would impart additional structural strength, and the Oracover fans among my friends have recommended this film as one of the toughest. Still, I've only used this technique once, and unless the surface is perfectly smooth, the grain of the wood and every other imperfection will show through the covering.

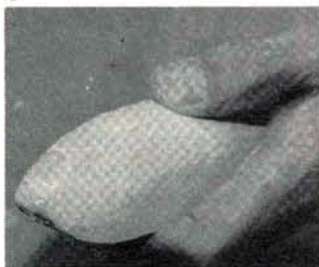
I have airplanes that are more than 10 years old that were covered without sealing the film onto the wood, except at the seams. In all those years of flying, the film has never come loose, and I've never had an airframe fracture or fail in the air. The structural strength was built into the airframe.

### AVOID GLUE ON THE SURFACE

It's very important to keep glue away from the outside surface. There will be many opportunities to put glue on a piece of



7



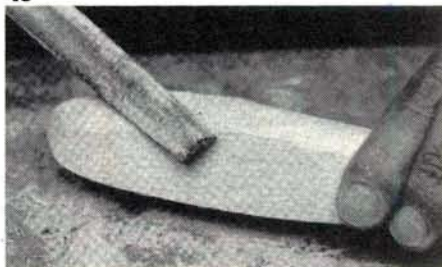
8



9



10



● 7: Removing a glop of CA from a piece of balsa is easier than you may think. ● 8: An ordinary file removes CA without damaging the balsa. ● 9: The CA has been removed and only a stain in the wood remains. Sanding and polishing will recover the smooth surface that existed before the spill. ● 10: My favorite tool for rough shaping is a rasp.

wood that will eventually become part of the outside surface. Don't do it! Impossible, you say? Perhaps. But avoid it like the plague! Think "covering" right from the beginning of the project, and remember to glue from the inside. To help you keep glue away from the outside surface of the wood, I offer the following suggestions for those areas where it's especially tempting to take thin CA and pour it on.

**Cap strips.** Apply thick CA on the rib at both ends, and then hold the cap strip stretched across the rib until the CA sets. After the cap strips are in place, turn the wing over and finish gluing them in place from the underside with thin CA (photos 1 to 3). The surface to be covered will be glue-free.

**Leading- and trailing-edge sheeting.** The leading edge (LE) is particularly important because you're building a laminated surface. The top and bottom sheeting are glued to both sides of the LE. Glued laminates always have some glue on the edge. The problem is compounded with the leading edge, because you'll be shaping the laminate and, therefore, feathering the glue, i.e., giving it an even greater surface area.

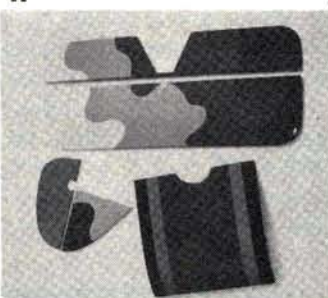
Shape the top and bottom of the leading-edge stock to a flat surface angle that extends the

forward contour of the rib top and bottom (Figure A). Don't round the leading-edge stock. The flatter the surface of the LE stock, the tighter the sheeting will fit, thereby minimizing the glue that's exposed to the surface.

First, place the sheeting on the leading edge. Don't pin it, except for position. Tape the sheeting as tightly as possible to the LE stock (Figure B), and glue from the back with thick CA. Keep pressure on the CA by rubbing your finger across the top surface of the sheeting on the LE. Glue only the spar and the sheeting. Glue the rib tips after the LE has been firmly mated into a laminated beam along the LE stock.

Once the sheeting has set on the LE, gently bend the sheeting away from the ribs, and put a bead of thick CA on each of the ribs. In tight places, tip the wing upward, and allow the CA to run down the rib edge to the LE. Pull the sheeting back, and press firmly with your hands with a brushing action toward the back of the wing. This technique ensures that all the glue is inside the structure.

11

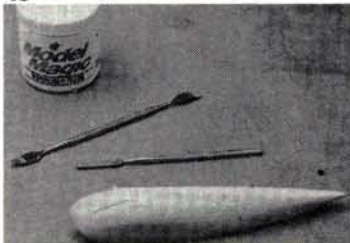


● 11: Covering small parts first is easier than gluing the model together and then trying to cover it! ● 12: These are the tools I recommend for shaping, sanding and polishing. They include a variety of sanding blocks, files and rasps, sandpaper cleaner and a tack cloth.

12



13

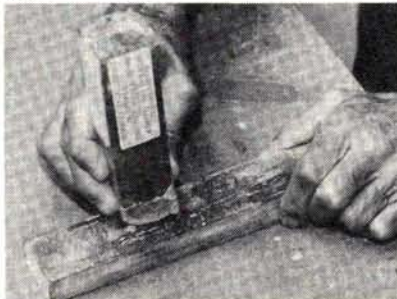


14



● 13: Lightweight filler, e.g., Carl Goldberg Models' Model Magic, can be used to fill dents before covering. Shown at left is a dented wing-tip block, filler, and Micro Mark® tools, which I use to apply filler. ● 14: Filler is applied to the dent.

15



16



● 15: A sandpaper cleaner (gum eraser) will triple the life of your sanding block by removing residue. Failure to remove residue can result in rough patches on the sanding block that will scratch the surface of your balsa. ● 16: I'm using 400-grit sandpaper with a wide sanding block, which gives me excellent control.



## COVERING R/C AIRPLANES

17



● 17: Here, I'm using a small sanding block with 600-grit sandpaper for final polishing. ● 18: Feel the surface with the hand that's not doing all the work! It will be more sensitive. ● 19: This is the finished tip block after a CA glob has been removed and a dent has been filled. Neither will show through the plastic film after the block is covered.

18



19



**Wing-tip blocks.** Hardened surface glue at this critical point will grab the covering and prevent it from shrinking properly over the wing tip. There's usually too much covering at the wing tip, and to avoid wrinkles, the covering must be shrunk as it's laid over the tip's surface and sealed to it. Therefore, glue must be applied carefully. Use thick

film wrap, butt the two edges together, and hold them firmly until set (photos 5 and 6). Only a small amount of glue should squeeze onto the surface. Remember, to keep surfaces glue-free, think "glue inside."

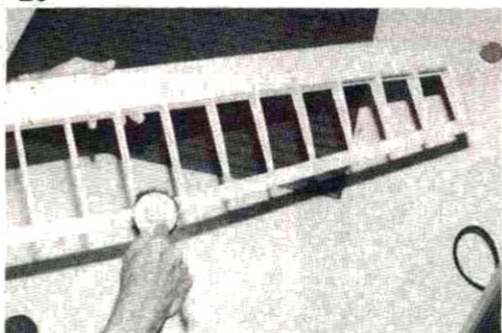
### REMOVING SURFACE GLUE

What can be done when the inevitable happens and a glob of

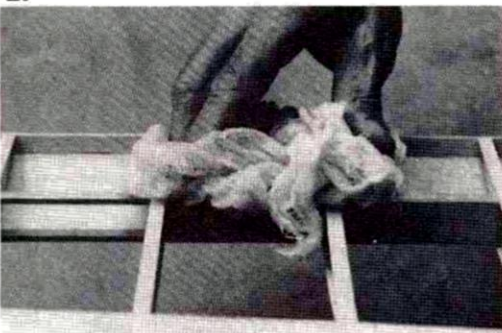
into the balsa around the hardened CA, but a metal file will remove the CA with minimal damage to the balsa. After you file the glue away, use a sanding block to finish the surface. The balsa will be slightly discolored from the CA residue that soaked into the wood, but the surface will be clean (see photos 7 to 9).

Epoxy is a sticky mess

20



21



● 20: Vacuum the model between each sanding! ● 21: The final touch is a complete wipe-down, inside and outside, with a tack cloth.

CA on the tip block, and allow about 1/4-inch clearance all the way around the outer edge (photo 4). When you press the tip block into place, glue will spread into the bare wood area, and very little, if any, will squeeze out to the surface.

**Solid balsa fins, rudders and stabilizers.** When two pieces of balsa are butted together to form a larger piece, carefully run a small bead of glue down the center of the edges to be joined. On a flat surface that's protected with waxed paper or

epoxy gets on the outside, or some thin CA sneaks through a joint?

If it's a major accident, it's better to replace the piece of wood than to try and clean it. Fortunately, with a little patience, many CA spills can be softened and removed with CA debonder—a product offered under various brand names. If a dent or a hole remains, it can be corrected with filler.

If you do get a glob of CA on the outside surface, the best way to remove it is with a metal file. Sandpaper will just dig a trough

before it sets. After removing the epoxy by carefully wiping it from the surface, clean the grain by wiping the wood with a cloth that's been soaked in alcohol or acetone. This will also thin any remaining epoxy and allow it to sink into the wood.

### COVER SMALL PARTS

Continue to think "covering" while you build, and keep in mind that covering small and uncomplicated parts is much easier than gluing the whole thing together and then trying to cover it. Of course, this means

dry-fitting everything prior to the final sanding. Make and fit the hinge slots, but don't glue them. Fit and sand the cowls, but remove them for covering. Cover any part that can be done separately, and glue it into place later. This minimizes the risk of damaging an already covered area when you handle your model to cover a complicated area.

### FILLING AND SANDING

Before you start the covering process, the balsa surfaces should almost shine. All the dings and pinholes must be filled with a lightweight balsa filler. (Several brands are available.) When the filler is dry, remove as much of the wood's grain as possible. Of course, the grain can't be eliminated completely, and the color will remain. The objective is to flatten the grain so that the harder, softer areas have a uniform surface.

Don't be tempted to "palm sand." Soft grain is eaten away more quickly than hard grain, and you'll therefore be accentuating the grain that you're trying to eliminate.

### SANDING BLOCKS

Always use a block for sanding. Several different sizes will come in handy, e.g., large ones are good for wings and other flat surfaces, but small sanding blocks can ruin what's supposed to be a flat surface. Different size dowels that are covered with sandpaper also come in handy for curved surfaces, such as fillets. These little curved surfaces must be carefully sanded, because you'll be sealing the covering to them. Blemishes here can ruin the appearance of an otherwise beautiful model.

### SHAPING, SANDING AND POLISHING

To some extent, sandpaper selection is a personal choice. The coarser grits in the 40- to

(Continued on page 100)









Handsome paint on the Minnesota Slicks club fleet.



Busy flight line in Champaign.

**T**IM LAMPE AND the folks at Great Planes once again conducted a fine contest at the Champaign County R/C Club in Champaign, IL. Held last June, more than 70 pilots participated in FAI, Scale and the three new AMA classes. The wind sock was horizontal most of the weekend, and the conditions were especially challenging for those who were flying new maneuvers or patterns for the first time.

The judges included Horace Hagen and Tom Unger—two men who judged in international competition. Prizes, including a Kyosho Bell 222 fuselage, Concept 30 SRs, a Kalt Enforcer and Futaba and Airtronics radios, were furnished by the major hobby distributors.

Here's how the 73 contestants registered:

- Class I (equivalent to the old AMA novice)—36 pilots
- Class II (equivalent to the old AMA intermediate)—13
- Class III (one notch below FAI)—8
- FAI—10
- Scale—6

*Tough competition and technical innovation*

by DATU RAMEL



Contest Director Tim Lampe oversees the trophies and plaques.

And here's what they brought: approximately 25 Kyoshos, 25 Miniature Aircrafts, 12 Kalts and 6 Hirobos. The average distance traveled by contestants?—650 miles. Three competitors came all the way from Brazil.

Several hobby vendors displayed their wares: Dave Carter of Rave's showed CNC-milled graphite servo trays and a Sportcab canopy for 60-ships. Mark Wilson, distributor for Hi-Products fiberglass blades and tail-drive accessories, hosted informal chats about blade integrity and where blades shouldn't go after a crash.

Pat Connell had another Ditzler auto paint-over-polypropylene fuselage on hand, and Brian Rasmussen posed the canopies he has painted (in some cases by spraying the outside Lexan surface) for the Minnesota Slicks club. My favorite paint job was Bob Sedler's blue-and-silver fun-scale Chicago Police Hughes 500.

A 20x40-foot tent was pitched in the pit area, with tables and chairs for those who didn't bring their own shade. Special-event T-shirts were for sale.

## CLASS I

There's an interesting story behind the 1st-place winner in Class I. For six years, 16-year-old Michael Lising of



Bob Sadler's "Cop Concept," a Hughes 500E fuse on Kyosho mechanics.

PHOTOS BY DATU RAMEL

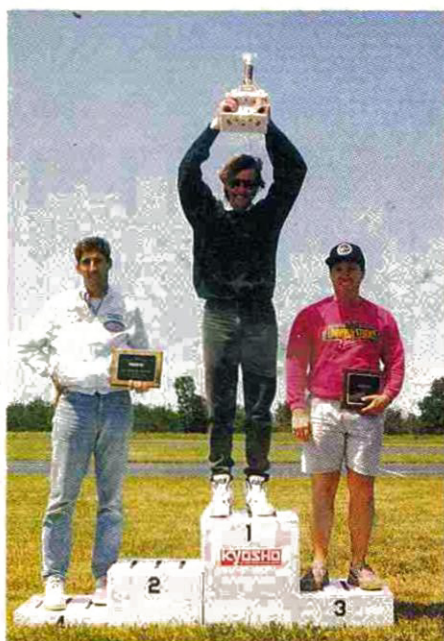


# KYOSHO

Columbia, MO, has been flying R/C planes with his dad, Alex. They both wanted to try helicopters but their budget wouldn't allow it until they found a used ready-to-fly Concept with helpful seller attached. The Lisings had already done their homework by studying several R/C helicopter videos before they started to fly in July 1991.

Every night for two weeks, they went to their club to practice, and by the end of this time, they could both hover. They didn't rush the learning process. In the early

because he was worried he didn't have enough negative pitch to keep the helicopter from floating. His win was very satisfying because it made all those conservative, slow, steady practices worth it. Michael is now learning nose-in hovering with his Concept. Only



From left to right: Mike Mas, Dan Chapman, Wendell Adkins.

months, they practiced hovering whenever it was too windy to take the fixed-wings up.

At the Kyosho Challenge, Michael's Concept 30 had a mix of SE and SX parts, an O.S. .32 engine, stock foam blades set to hover at 6 1/2 degrees and low pitch at minus 1 degree. Michael said he was lucky to have caught few gusts in the windy rounds



From left to right: Mark Wilson, Jeffery Reed, Paul Soha, Mark Potts.

after he feels confident with this maneuver will he consider trying a 60-size heli.

## CLASS II

The new Class II pattern retains the translational landing from the old Intermediate pat-



From left to right: Mark Wilson, Mike Ellis, Don Chapman.

tern. This maneuver still causes fits with the pilots because you must keep your eye on two things at once—the heli and the landing target—during the approach. Then, of course, the machine won't touch down when you



From left to right: George Jung, Dean Hess, Michael Lising, Bill Jeric.

## WINNERS

### Class I

1 Michael Lising.....	2,000.00
2 Dean Hess.....	1,930.26
3 Bill Jeric.....	1,923.08
4 George Jung.....	1,885.27

### Class II

1 Paul Soha.....	2,000.00
2 Jeffrey Reed.....	1,931.63
3 Mark Potts.....	1,862.07
4 Mark Wilson.....	1,771.04

### Class III

1 Mike Fortune.....	1,993.27
2 Norman Labhart.....	1,952.08
3 Kent Officer.....	1,945.69
4 Robert Akers.....	1,803.14

### FAI

1 Dan Chapman.....	423.5
2 Wayne Mann.....	413.5
3 Wendell Adkins.....	368.5
4 Mike Mas.....	362.0

want it to because of ground effect!

Paul Soha's 2,000 points meant that he had the top score in both of the rounds counted. This is an example of normalized scoring, where each pilot's score is computed and compared with the round winner's score on a 1,000-point scale. Pattern fliers have done this for years, but it's new to helicopter contests. Mark Potts, last year's novice winner in Champaign, says the normalized scores make the results fairer because the effects of bad weather—like



From left to right: Bob Akers, Norm Labhart, Michael Fortune, Kent Officer.

## SCALE

Place	Pilot	Fuselage	Mechanics
1	Mike Ellis	Yellow Aircraft Jet Ranger	Kalt Enforcer
2	Ted Schoonard	Hughes 500E	X-Cell 30
3	Don Chapman	Miniature Aircraft Hughes 500E	X-Cell 30
4	Mark Wilson	Hirobo Lama	Hirobo



## CHAPMAN TWIN TAIL ROTOR

**D**an Chapman won FAI with an X-Cell 30 with a twin tail rotor. The tail-rotor shaft extends from both sides of the tail casing with a hub, a pitch slider and a pair of blades at each end.

Don Chapman Sr. started tinkering with this configuration three years ago, and his goal was to get model helicopters to track better "upstairs"—in fast forward flight or in aerobatics. Helis need tail rotors to counteract torque and to provide yaw (rotational) control, but in forward flight, some balance must be achieved between a tail rotor's thrust effect and its weather-vane effect.

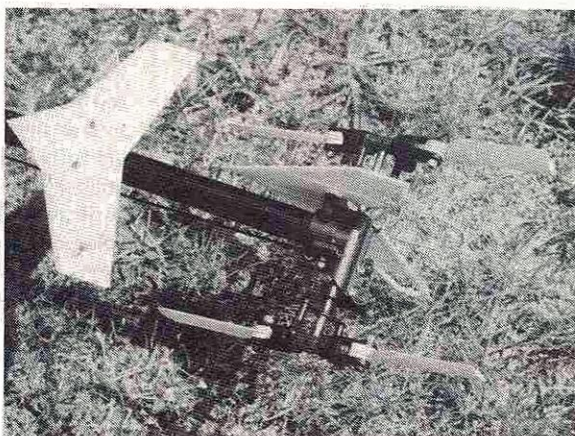
The typical 30-size tail rotor with a 9-inch-diameter disk acts like a 65-square-inch vertical fin. The problem is that if you were designing an aircraft to fly straight at high speed, would you put its tail fin or vertical stabilizer 3 to 4 inches to the side of the machine's center? The Chapman Twin is a real innovation in this area.

The two pairs of cut-down X-Cell 30 tail-rotor blades have an 8-inch-blade disk diameter instead of the stock 9 1/2 inches. The hubs are placed at equal distances from the tail boom so that there's no adverse yaw in forward flight. The disks don't have the same base line (rudder stick centered) pitch setting. In the hover, the primary disk on the right side has positive pitch for anti-torque thrust and the secondary disk has flat pitch. With a right rudder command for pirouetting clockwise against torque, the primary disk goes positive and the secondary disk goes slightly positive. With a left rudder or counterclockwise command, the primary disk goes to less positive and the secondary disk goes to negative. In a normal heli, the tail-rotor pitch is always more or less positive, thrusting against torque. In the Chapman Twin, the secondary disk at negative pitch will actually thrust with torque (counterclockwise).

In forward flight, the Chapman Twin exhibits what Don calls the "box-kite effect": the helicopter tail stays behind the rest of the heli with no wiggling or stick fiddling because the airflow back there is channeled between two parallel flying surfaces. Whatever re-trimming is necessary for forward flight after leaving the hover is minimal compared with what we're used to, namely, using rudder off-

set and throttle-rudder mixing then finding out all that computer wizardry works at only one velocity. (Thus, when you go over the top in a loop at a third the air speed, you still have to lean on the rudder stick to keep from quarter pirouetting inverted.)

The smaller tail-rotor diameter means you can run longer main blades without the weight and possible imbalance penalty of a longer tail boom. Pirouettes in windy



*De Tail of de DC Twin. Dual disks/two pairs of t-r blades on the Chapman ship.*

conditions are smoother because there's always at least one tail-rotor disk generating thrust. (As mentioned earlier, at no time do all the tail blades go to flat pitch.) Don says the Twin helps the tail avoid snapping around faster than you want when rotating through a crosswind heading. The Top Hat maneuver and the vertical one-and-a-half spins of the 540 stall turn can be flown more confidently.

Test flights by Wayne Mann and Curtis Youngblood revealed an unexpected benefit of two pairs of blades at the back. It flies well backwards! Yes, all helis fly well backwards, or tail first, in the sense that fixed-wing craft don't fly backwards at all. (Blimps fly just OK backwards. Hot-air balloons don't have a back). Don's account of one of Curtis's sequences with a Chapman Twin demonstrated the freestyle potential of the design. Curtis pulled up to vertical, stalled and started a tail slide, dove tail first, rolled, dove some more, did another tail-first vertical roll, pushed the nose 90 degrees and recovered to a full-throttle fly past, backwards, inverted and on the deck.

Think of that second tail-rotor disk as a phantom fin. In forward flight, it works like a tail fin to balance the yaw forces, and in hovering, it adds its thrust to the rotational control system. Call the Chapman Twin a winner.

Sunday's gusts—are factored out. "If the top pilot is having a bad round," says Potts, "then everyone will have a lower score." Reed and Potts once again placed well for the Northern Illinois Helicopter Club. Gary Watson, who flies cargo planes for a living, placed 5th in his first contest.

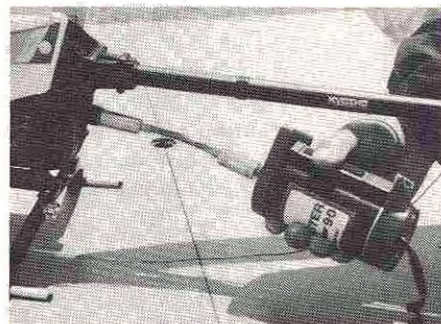
## CLASS III

The new Class III pattern, which is more difficult than the old Intermediate but not as difficult as FAI, featured the Hovering Hourglass and the Immelmann (a half loop followed by a half roll). John Adams, Bob Akers, Mike Fortune and Kent Officer renewed their intermediate-level rivalry from last year's Nats, and Norm Labhart brought some FAI experience to the fray.

Wendell Adkins has a theory that most .60-size-contest pilots with their sights set on the Nats (usually in July) prepare for the Kyosho Challenge with just a week of flying their .30-size ships. Nevertheless, he's amazed at how intense the competition is in Champaign. "It's not run-what-you-brung; it's serious!," says Adkins.

## FAI

Dan Chapman flew an 8-pound, 4 ounce, X-Cell 30 with 9:1:4.6 drive ratios, a twin-disk tail rotor, a shaft drive, cut-down tail-rotor blades, a 54-inch main disk (4 inches over

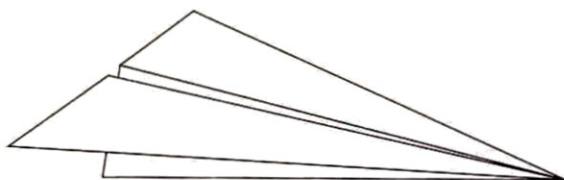


*Pete Parks and members of the Lake Geauga, Ohio Heli Association developed this starting system using a one-way bearing coupler at the end of a flexible shaft.*

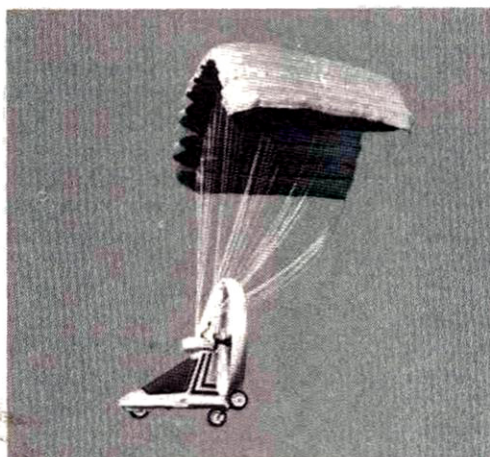
stock), 129-gram Hi-Products fiberglass blades, altered Super Tigre .34 with a .350-bore O.S. 76 carburetor and an O.S. no. 6 plug. The prototype Twin Tech exhaust system with two V-Tech mufflers in a "cascaded" configuration was designed to accommodate high-power exhaust and still be quiet without the weight of a 40- or 50-size muffler. He also uses 1,950 revs upstairs, 1,650 revs in the box, a blend of Byron Fuels, a Futaba PCM single-stick radio modified to use Super Seven programmability and mixing, 9203 servos and a 153 gyro.

Like many of us, Dan must squeeze heli-





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## KYOSHO

copter flying into a busy schedule. One measure of Dan's commitment to improving his flying is that he uses his precious air time just for practicing the FAI pattern. It's not that Dan doesn't want to hot-dog or sport-fly, he simply doesn't have time for it, given his focus on competition.

## DEMONSTRATIONS

On Saturday and Sunday, Bob Sims, a Kyosho factory flier, flew a demo with an aerobatic Concept 60. Bob showed perfect orientation flying upright or inverted, whether traveling forwards or backwards, and he impressed everyone with maneuvers such as sideways loops from inverted, traveling rolls and much more. Look for Bob at other events throughout the summer. Bob attributes much of his success to the many hours that he has spent with computer simulators.

Mike Mas demonstrated one of the new breed of fun-fly airplanes (although it had a real fuselage instead of a boom), and he showed that he can hover more than just helicopters. He caught the airplane at the end of the demo. Finally, Dwight Shilling demonstrated his F3C competition Concept 60 with Kyosho's latest interceptor body. This machine exhibited very fast forward flight.

Tim Lampe, event CD, specifically gears the Challenge to beginners. At previous events, there were two flight lines for beginners, but this year, there weren't enough judges. With only one flight line, novice contestants flew only three rounds each. Feeling that they should have had more rounds, Tim thoughtfully refunded \$5 to each novice-class pilot. Tim's efforts to make the Kyosho Challenge as enjoyable as possible for all participants resulted in a very successful event. If you can make next year's Challenge, I recommend it. ■

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## CENTER ON LIFT

(Continued from page 72)

please send them to me care of *Model Airplane News*. See you next month.

### SOURCES

Selig, M.S., Donovan, J.F. and Fraser, D.B. (*Soartech 8*)  
*Airfoils at Low Speed*. Virginia Beach: H.A. Stokley.  
 Vernon, Cedric. "Trim Drag." *Technical Soaring*, Vol. XVI, No. 1, pp. 17.

## F-15

(Continued from page 32)

You can finish the aircraft in two ways. It can be all paint, or you can paint the fuselage and cover the flying surface with plastic film. Carl Goldberg\* Ultra Coat Plus Film is great for this application. The choice is yours. To prep the fuselage, sand all seams and fill any gaps or voids. Lightly prime the fuselage, then sand down the primer and correct any imperfections. Lightly re-prime the fuselage, sand with 400-grit paper, use a tack cloth and apply the finish coat of your choice.

If you're fiberglassing the wings and surfaces, use 3/4-ounce cloth and resin, sand them down and prep them in the same manner as the fuselage. Remember, keep a light hand when prepping and painting. Ninety percent of a great paint job is what you can't see. My

aircraft was finished with cloth and resin and painted with automotive urethane.

### FINAL ASSEMBLY

When the aircraft has been painted and all the equipment has been installed, cut and glue in the hinges and control surfaces. Re-install any servos and wires. Make all the control rods and hook them up. Follow the manual for control-surface throws. Put the battery pack as far forward in the nose as possible to achieve balance, and then install it securely in the nose. Install the thrust tube and engine assembly. Connect all fuel lines, tie them off, and attach a filter to the carburetor. Go back and double-check all nuts and bolts, the CG and all control-surface operations.

A fully equipped Ultra Eagle with retracts, an O.S.\* .91 engine and a complete paint job will have a ready-to-fly weight (less fuel) of approximately 12 1/2 to 12 3/4 pounds.

### AT THE FIELD

The Ultra Eagle will operate from any reasonably smooth grass field. Normal takeoff distances, depending on the field and the weather, are 125 feet to 175 feet. The plane flies with authority and grooves very well. New

pilots may want to use low rates on their first flights. The plane handles much like a pattern ship. It's very predictable and has no nasty flight characteristics.

For the money, the Ultra Eagle is a bargain that's hard to beat. It offers a quick, relatively inexpensive way to enter the ducted-fan scene. A Dynamax fan installation is being worked on and will be offered in the near future as an option.

If you've been wanting to get into ducted fans but didn't know which kit would be a good choice, the Ultra Eagle will allow you to turn and burn with the best of them.

\*Here are the addresses of the companies mentioned in this article:

Top Gun Aircraft, 418 W. Jefferson St., Ottawa, IL 61350.  
 Zap; distributed by Frank Tiano Enterprises, 15300 Estancia Ln., W. Palm Beach, FL 33414.

Byrojet; distributed by Byron Originals, P.O. Box 279, Ida Grove, IA 51445.

Spring Air Products, P.O. Box 37-3218, Satellite Beach, FL 32937.

Carl Goldberg Models, 4734 West Chicago Ave., Chicago, IL 60651.

O.S.; distributed by Great Planes Model Distributors, P.O. Box 9021, Champaign, IL 61826.

Airtronics Inc., 11 Autry, Irvine, CA 92718.

S&W Hobby Supply, P.O. Box 208, Tatamy, PA 18085.

Jet Model Products, 211 N. Mullen Rd., Belton, MO 64012.



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Price: \$1299.99

Hobby Dynamics Distributors (a division of Horizon Hobby Distributors), 4105 Fieldstone Rd., Champaign, IL 61821; (217) 355-0022.



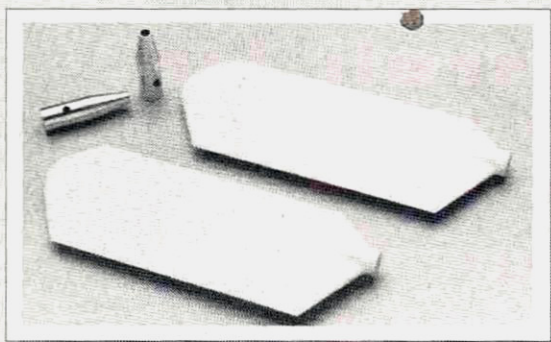
### GREAT PLANES MODEL DISTRIBUTORS Stabilizer Blades & Weights for Concept 60

For quicker steering and hot-dog flying, use these lighter stabilizer blades and weights. The weights are made of aluminum, and the blades are a lightweight white plastic.

Part nos. KYOE7515 (light stabilizer weights); KYOE7570 (light stabilizer blades).

Price per set: \$12.25

Great Planes Model Distributors, P.O. Box 9021, Champaign, IL 61826; (217) 398-6300.



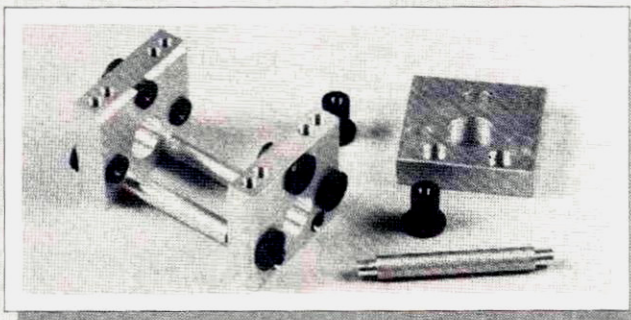
### MINIATURE AIRCRAFT U.S.A. X-Cell .60 Rubber-Isolated Engine Mount

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## PROP SELECTION

(Continued from page 46)

loading in ounces per square foot of wing area and the faster it must fly in level flight (or at higher angle of attack with higher drag).

Most models, in level flight, fly at lift coefficients of 0.2 to 0.3. If you know the model's weight and calculate its wing area in square feet, its wing loading is easy to arrive at. Figure 5 provides a quick way to estimate the model's flight speed. Say the model's wing loading is 20 ounces per square foot; reading upward from 20 to lift coefficients of  $C_L$  0.2 and 0.3, level flight speeds are, on the left, 40 to 48mph. These speeds are minimums; something more is required for climbing and other maneuvers. Adding 25 percent gives speeds of 50 to 60mph and a mean speed of 55mph.

Now refer to Figure 6: the rpm-pitch speed monograph. Place a straightedge at 55mph in the central, level-flight-speed column, and read off the static rpm and corresponding pitches that will provide 55mph. For example: a 6-inch pitch at 10,000rpm or a 7-inch pitch at 8,700rpm both provide 55mph.

Nomograph Figure 6 is based on a 15-percent slip and on a gain of 10 percent in engine revolutions as the prop "unloads" from a static position at high angles of attack to the level flight speed at much lower angles of attack.

Part 2 will continue this discussion of propeller selection. ■

## STARFIRE

(Continued from page 52)

face throws at  $3/8$  inch each way on the ailerons,  $3/4$  inch each way on the elevator and 1 inch each way on the rudder, so that's exactly what we did.

### FLIGHT

Our 2-stroke O.S.\* 46 has performed flawlessly in several airplanes. It's an ABC, Schnuerle-ported engine that has plenty of torque and power, and it doesn't require a tuned pipe. With occasional, minor mixture

adjustments, this engine always pulls crisply throughout the power band—an attribute that's especially critical during roll-out and initial takeoff with a hot airplane.

The Starfire 40 certainly is a hot airplane. It doesn't take more than a few minutes for that to become crystal clear. After it has reached a relatively high speed, the Starfire 40 rises off the runway with very little elevator-control input. We use a simple Futaba\* Conquest FPT 4NL 4-channel radio, because an assortment of doodads and widgets simply isn't necessary to fly this airplane.

The Starfire is definitely a plane that likes speed. We started off using an 11x7 $3/4$  Rev-Up\* prop but switched to an 11x6 APC\* to get the engine to rev a little higher. This simple change helped to elevate the Starfire's turning performance from very good to outstanding. With the 7 $3/4$  prop, the plane was just a touch mushy in the middle of a turn.

The rock-solid feel of the 11x6 during all maneuvers impressed us. With comparatively large control surfaces and fairly long recommended throws, the Starfire reacts extremely quickly to any stick movement. One flight tester commented during repeated rolls that the Starfire "really cracks them over." It certainly does. In fact, the Hobbico plane does every maneuver in the book with precision and authority. We were somewhat taken aback by the radical Lomcevak and snappy snap rolls.

Of course, just as important as crazy gyrations is the ability of the plane to maintain stability during more calculated, gradual maneuvers. The Starfire shines in this area, too. One reason is that the Starfire isn't "skittery" in the air. It reacts to the pilot's input with precision, but it manages to cancel out forces from wind gusts. That's because of the clean wing design and slight dihedral.

(Continued on page 100)

# TOP GUN

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"THE ULTRA EAGLE"  
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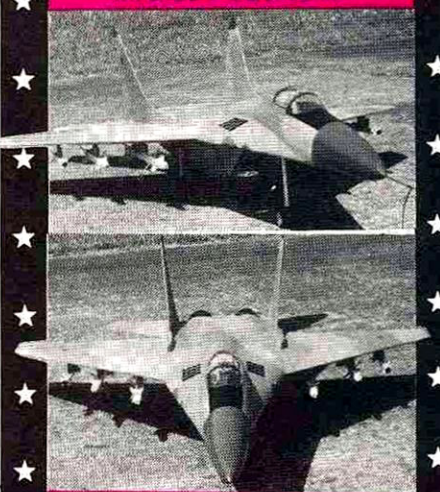
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# Aero\*Comp

## Performance Characterization Software for Electricians



by TOM ATWOOD

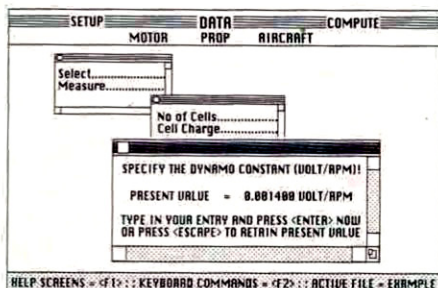
**I**F YOU HAVE ever thought about creating your own electric-powered model aircraft, or if you have already built several of your own design, you have, no doubt, pondered several motor/battery/planform combinations in the quest for optimal



To test the software's estimates, Jay Weiner (right) helps me check the Uhu's full-throttle rpm. We used an SR Smart Charger to check amperage.

performance. Simple formulas and rules of thumb have been published that help the electric modeler put all the pieces together, but for many, it has not been a simple task to quickly estimate flight performance when there are several motor, gear-drive and battery combinations to choose from.

Not until now, that is. USR&D's AERO\*COMP software considers the key factors that impact the flight performance of your existing or hypothetical electric model, accounts for the interrelationships of the myriad variables involved, and then characterizes the model's likely flight performance. The authors—physicists with an affinity for aeromodeling—have fashioned a program that characterizes performance based upon the physics of model flight.



Sample input screen.

### USING AERO\*COMP

The program is easy to use and understand. It asks for a basic set of variables and then characterizes the flight performance of the aircraft so defined (see Figure 1). AERO\*COMP's designers opted for a lively interface that relies on separate windows for inputting data relating to motor, propeller and aircraft parameters. Once the information has been entered, it can be reviewed on a single input screen. With two more keystrokes, the results screen can be viewed (computation of flight performance is nearly instantaneous when you hit the results screen button).

### AN END TO MOTOR MYSTERIES?

One of the interesting things about this program is its unveiling of the details of motor performance. I ran a performance analysis on the Tom Hunt Pylon Racer using three of the many motors that are listed in the program: a Leisure\* 05 (modified), an Astro\* FAI 05 and a Kyosho\* LeMans 360PT motor. The pylon racer has a 40-inch wingspan and, in this example, is configured to run on seven 1000mAh cells. A 6x6 prop pulls the 2-pound plane. The computer predicted the following differences in takeoff, i.e., full-throttle, performance:

Motor	Motor current	RPM	Duration
Leisure	29.0A	13,112	2.1 min.
Astro FAI 05	25.7A	14,201	2.3 min.
Kyosho LeMans 360	30.0A	14,145	2.0 min.

The benefit to the modeler is the characterization of motor performance in readily understandable terms, e.g., current, rpm and duration with a given prop and battery. If you have an odd assortment of motors and want to see how

### SPECIFICATIONS

**Name:** AERO\*COMP  
**Type:** Electric flight-performance characterization  
**Compatibility:** IBM PCs and 100-percent compatibles; distributed on a single, copy-protected, 5¼-inch, 360K floppy disk  
**Display:** VGA, EGA, CGA, or Hercules monochrome monitors  
**Price:** \$79 introductory price through 30 September '92; \$99 thereafter (add \$3 for postage and handling, plus 6 percent NJ state tax if applicable)

they stack up in different applications, the program points the way.

When you pick a motor from the motor selection menu, the program automatically inserts motor resistance (ohms), the motor "dynamo constant" (volts/rpm), and, if it has a gear drive, the standard gear ratio for that motor. The program also offers thrust and rpm data for any prop you would like your selected motor to spin. These values were measured in the lab by the program's creators.

What if you have a motor that is not in the program? Help screens tell how to measure this data using a drill press, lathe, or other motorized device that will spin up your motor to a known rpm. Simply measure voltage and current generated while the motor is spinning, follow the simple arithmetic set forth in the program, and you have the data the program requires.

The user guide and help screens note that because of "non-uniformities" in the manufacture of most motors, the performance of individual motors can vary by as much as 20 percent (as a sidenote, AstroFlight claims less than 1% variation in the performance of their motors when shipped). If your motor is listed in the program but its performance differs from the predicted results, you can adjust the resistance or dynamo constant until the program



FIGURE 1	
INPUTS	RESULTS
• Number of cells in the drive-pack battery	• Takeoff rpm
• Cell capacity (milliamp hours)	• Takeoff thrust (lbs.)
• Number of motors	• Takeoff distance (ft.)
• Motor resistance (ohms)	• Takeoff duration (secs.)
• Motor dynamo constant (volts/rpm)	• Motor voltage at takeoff rpm
• Motor gear ratio	• Motor current at takeoff rpm (amps)
[preceding motor data is automatically inserted if motor is chosen from program list]	• Wing area (sq. ft.)
• Prop diameter and pitch (ins.)	• Wing loading (oz. per sq. ft.)
• Wing type (monoplane, biplane, triplane)	• Stall speed (mph)
• Wingspan (ins.)	• Maximum air speed considering prop pitch (mph)
• Wing midspan (ins.)	• Maximum airspeed considering total airplane drag and takeoff thrust (mph)
• Wing root and tip chords (ins.)	• Maximum rate of climb (ft. per min.)
• Average wing thickness (ins.)	• Thrust duration at full throttle (mins.)
• Aircraft all-up weight (lbs.)	• Thrust duration at stall speed (mins.)
• Runway (paved; close cut grass; 2-inch grass; water; hand-launch)	• Whether the aircraft is expected to fly
• Runway elevation (ft. above sea level)	

faithfully reflects your motor's behavior.

## PROGRAM PHILOSOPHY

USR&D's original intention was to write a program that would predict whether an electric airplane would fly at all—hence, they adopted a conservative approach. For example, all calculations are performed under the assumption that landing gear is down, which, of course, exacts a drag penalty. Accordingly, the real-world flight performance of very sleek, low-drag electric gliders can be expected to slightly exceed the program's projections.

Estimates of the duration of full-throttle climb-outs assume peak battery voltage throughout, when in fact that voltage diminishes with time (thus, the program conservatively estimates full-throttle duration). Similarly, the estimate of maximum duration is keyed to flight at stall speed—which will obviously be tough to maintain with any real model! Part of the fun is beating the predicted full-throttle duration, or trying to achieve better than 50 percent of the maximum low-throttle duration.

A desire to limit the program's size so that it could fit on a single 360K, 5<sup>1</sup>/<sub>4</sub>-inch, floppy disk also led to some simplifications in the program's current version. An "average" airfoil coefficient of lift is as-

sumed, as is a wooden propeller. (Rev Up\* props were used in testing: Help screens note that on the test stand, wooden props were found to be slightly more efficient than plastic ones.)

For this modeler, these simplifications do not affect the basic utility of the program, even if they do offer room for

## SAMPLE CHARACTERIZATIONS

**Graupner\* Electro Uhu.** I decided to test my aging (and much repaired) 3.76-pound, FAI 05-powered Electro Uhu, since I know its performance fairly well. It is a heavy airplane because of the additional items it carries, such as spoilers, spoiler servo, separate radio battery, multi-layer fiberglass reinforcement of the forward and aft fuselage, and a geared, cobalt motor and 12x7 folding prop.

The plane had been flown in recent months with a complement of 10, "cut" sub-C cells, e.g., Sanyo\* 900mAh SCRs,

or SR\* 1100mAh MAXs. Although the motor is rated for 7 cells, I found better performance as additional cells were added. (This is not recommended by the manufacturer.) I asked AERO\* COMP what performance change would result if I switched to an Astro FAI 15, which was designed for 10 cells. The results suggested that I could increase the total

climb-out (full-throttle duration multiplied by maximum rate of climb) by approximately 500 feet. I replaced the 05 with the 15 and observed the predicted, improved performance at the flying field. Although my Uhu has never weighed more, the plane climbs higher and flies longer with the 15, because the 15 is pulling fewer amps while providing about the same performance.

FIGURE 3

## Fokker DVIII Field Test

—data provided by Martin Irvine

No. of cells:	18
Cell capacity:	1200mAh
Motor:	Astro Cobalt 40 (std) geared
Prop:	13x7.5
Wingspan:	65.5 ins. (monoplane)
Wing midspan:	16.5 ins.
Root chord:	11.75 ins.
Tip chord:	8.5 ins.
Weight:	6.88 lbs.
Runway surface:	short (close-cut) grass
Runway elevation:	350 feet above sea level

	Estimated	Measured
Takeoff rpm	6,444.6	7,500
Takeoff thrust	3.7 lbs.	
Takeoff distance	43.5 ft.	41-46 ft.
Takeoff duration	2.4 secs.	2-3 secs.
Motor V at takeoff rpm	18.9V	20.8V
Motor A at takeoff rpm	25.6A	23A
Wing area	4.8 sq.ft.	
Wing loading	23.0 oz./sq. ft.	
Stall speed	23.6mph	21.5mph (est.)
Max air speed given prop	45.8mph	
Max air speed given drag	63.5mph	
Max rate of climb	505.5 ft./min.	
Duration at full throttle	2.8 mins.	3.4 mins.
Duration at stall speed	14.9 mins.	7.5 mins.

Although the 05 was "overworked" with 10 cells, it weighs a couple of ounces less than the 15. In a competition with a mandatory short motor run, the 05 could provide a slight weight advantage.

Figure 2 shows a comparison between the estimated and measured performance with the geared FAI 15. This field test utilized a popular wooden 12x7 prop. I tried several 12x7 props and found a variety of results. One popular 12x7 folding prop showed significantly greater RPM and lower current draw. Using the program, I found that a 12x3.6 wooden prop would provide the RPM and current draw associated with the folder! The folder is a scimitar type, and the wooden prop a paddle type. Careful measurement also revealed that the folder has a rapidly declining pitch as you move from the tip toward the hub. The moral here is that propellers can vary greatly in performance despite their nominal pitch values.

FIGURE 2

## Graupner Electro Uhu (modified) Field Test

No. of cells:	10
Cell capacity:	1000mAh
Motor:	Geared Astro Cobalt 15 FAI
Prop:	12x7
Wingspan:	66.5 ins. (monoplane)
Root chord:	8 ins.
Tip chord:	5.5 ins.
Wing thickness:	.55 in.
Weight:	3.76 lbs.
Runway type:	Hand-launch
Runway elevation:	150 ft.

	Estimated	Measured
Takeoff rpm	6,389.7	6,500
Takeoff thrust	2.6 lbs.	
Motor V at takeoff rpm	9.5V	9.6V
Motor A at takeoff rpm	33.6A	35A
Wing area	3.1 square feet	
Wing loading	19.3 ounces/sq. ft.	
Stall speed	21.6mph	
Max air speed given prop pitch	42.4mph	
Max air speed given total drag	79.5mph	
Max rate of climb	1277.0 ft./min.	
Duration at full throttle	1.8 min.	2 min.
Duration at stall speed	15.2 min.	6 min.



**Fokker DVIII monoplane.** Figure 3 shows that AERO\*COMP's estimated performance for the Fokker closely matches predicted values.

**Leisure Amptique monoplane.** Figure 4 shows that the program's estimated climb rate for a geared, FAI 05-powered Amptique was approximately matched at the flying field. The plane was equipped with a folding 14x8.5 propeller. A Casio altimeter watch was placed onboard, and the airplane was brought down after a 1-minute climb. Current draw and rpm were within 10 percent of the predicted value.

A performance characterization was also run on the Amptique using a direct-drive FAI 05 spinning an 8x5 prop. Although thrust duration increased marginally owing to a slight lessening of current draw, the maximum rate of climb fell from 1,400 feet per minute with the geared system to 758 feet per minute with the direct-drive system. These results certainly argue in favor of using geared drive systems.

#### THE BEST PROP FOR DURATION?

Experiments on a test stand will tell you that the work required to spin a prop increases faster as inches are added to the diameter than it does as inches are added to pitch. Raising the pitch, up to a limit, also increases potential aircraft speed. Would a prop with a smaller diameter and a higher pitch improve the performance of my Electro Uhu? I asked AERO\*COMP. It is interesting to compare prop selection with climb rate, maximum speed and duration estimates (except for the prop, the plane is configured as in Figure 2):

Prop	Max Airspeed (prop)	Climb Rate	Dur. (full/stall)
12x7	42.4mph	1,277.0 ft./min.	1.8/15.2 min.
11x11	65.0	1,273.1	1.7/14.3
11x10	60.7	1,232.1	1.8/14.7
10x10	67.5	1,015.6	2.1/15.8
9x9	68.7	675.4	2.8/17.5

This chart suggests that a 10x10 propeller will produce a climb rate that is 80 percent of that obtainable with a 12x7, but the maximum air speed is projected to be 60 percent greater, and full-throttle duration, 17 percent greater. If you want to emphasize air speed and motor run, AERO\*COMP suggests that the 10x10 is the better choice.

At a recent electric fun fly, columnist David Baron tested this duration insight in a touch-and-go competition by changing from an 11x7 to a 10x8 prop on his Florio\* Nifty Fifty (14, 1000mAh SCR cells; geared cobalt 15). He was able to increase the number of touch-and-goes from the low 40s to 61, which won the event. The plane didn't spring off the ground quite as fast, but the increased motor run made the difference. The program facilitates this kind of analysis.

#### CONCLUSION

Although I have not examined every facet of AERO\*COMP under a microscope, limited tests (which include several comparisons not reported here) show that AERO\*COMP tells the truth when it formulates the general performance characteristics of electric models. The predictions have consistently and reliably indicated whether a plane will fly, and whether it will do so well or marginally.

The User Guide and Help screens are well prepared, yet the program is so simple to use there has been little need to use them. It's worth noting also that the program can be used to model the flight performance of aircraft that are powered by other means of propulsion. Simply pick a motor and prop combination and then regulate propeller rpm

FIGURE 4

#### LEISURE AMPTIQUE

—data provided by Larry Sribnick

No. of cells:	7
Cell capacity:	650mAh
Motor:	Astro Cobalt 05 FAI geared
Prop:	14x8.5
Wingspan:	58 ins.
Wing midspan:	53 ins.
Root chord:	9 ins.
Tip chord:	0.25 in.
Wing thickness:	0.90 in.
Weight:	2.31 lbs.
Runway surface:	hand-launch
Runway elevation:	150 ft. above sea level

	Estimated	Measured
Takeoff rpm	4,143.6	4,500
Takeoff thrust	2.1 lbs.	
Motor V at takeoff rpm	6.1V	
Motor A at takeoff rpm	38.7A	36A
Wing area	3.5 square feet	
Wing loading	10.6 ounces/sq. ft.	
Stall speed	16.0mph	
Max air speed given prop	33.4mph	
Max air speed given drag	61.8mph	
Max rate of climb	1,407.0 ft./min.	1,210 ft./min.
Duration at full throttle	1 min.	1.16 min.
Duration at stall speed	9.8 mins.	

by adding or subtracting cells or fractions of cells. There is much flexibility in AERO\*COMP, and the program should appeal to many.

\*Here are the addresses of the companies mentioned in this article:

**AERO\*COMP** is published by USR&D Corp., P.O. Box 561, Denville, NJ 07834-0561.

**Leisure Electronics**, 22971 B Triton Way, Laguna Hills, CA 92653.

**Astro Flight Inc.**, 13311 Beach Ave., Marina Del Rey, CA 90292.

**Kyosho/Great Planes Model Distributors**, P.O. Box 9021, Champaign, IL 61826.

**Rev Up**; distributed by Progress Mfg. Co., P.O. Box 1306, Manhattan, KS 66502.

**Graupner**; distributed by Hobby Lobby International, 5614 Franklin Pike Cr., Brentwood, TN 37027.

**Sanyo Electric**, Battery Division, 200 Riser Rd., Little Ferry, NJ 07643.

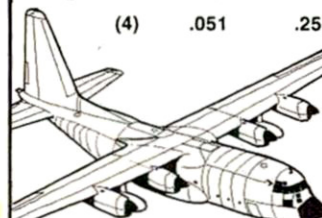
**SR Batteries Inc.**, Box 287, Beuport, NY 11731.

**Florio Flyer**, P.O. Box 88, 149 Scotland St., Daguer Mines, PA 15831.

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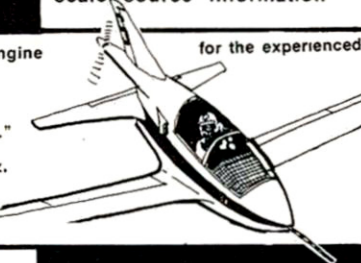
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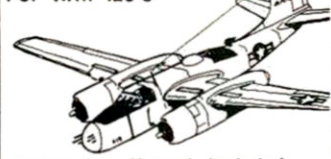
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## STARFIRE

(Continued from page 93)

Inverted flight is equally blissful. A slight amount of down-elevator is the only adjustment the pilot must make. The plane stays rock solid, and that makes outside loops a rather easy proposition.

No airplane can be perfect under all conditions, and the Starfire 40 has its weakness: slow flight. After you've throttled the plane back, it no longer feels as if it's on rails. This is definitely not a crawler we're dealing with here. The Starfire was never intended for novices. It's designed to deliver thrills to seasoned sport pilots, and that it does.

\*Here are the addresses of the companies mentioned in this article:

**Hobbico/Great Planes Model Distributors**, P.O. Box 4021, Champaign, IL 61824.

**O.S.**: distributed by Great Planes Model Distributors.

**Futaba Corp. of America**, 4 Studebaker, Irvine, CA 92718.

**Rev-Up**: distributed by Progress Mfg. Co., P.O. Box 1306, Manhattan, KS 66052.

**APC Props**, P.O. Box 938, Knights Landing, CA 95645.

## COVERING

(Continued from page 82)

60-grit range are used for shaping and are good for cutting through hard grains and adhesives. Depending on the weight of your hand, you may prefer a 100- to 80-grit paper for rough sanding.

I differentiate between final shaping and rough shaping. Rough shaping is done with knives, gouges, rasps and saws. Final shaping puts the surface within less than 1/16 inch of its finished shape (photos 12 to 19).

Some modelers use 220-grit sandpaper to smooth the final shape to an interim finish. But my hand is a little too heavy for it, so I use 320-grit paper. The shape should be smooth but not shiny.

Once the final shaping has been accom-

plished, the polishing process begins. Polishing can also be done with 400-, 600- and even 1,000-grit sandpaper. They all provide a finish on the wood that will "disappear" under the covering. I often jump from 320- to 600-grit sandpaper. Occasionally, on leading edges (always a hard surface because of the glue/wood laminate), I use 400-grit in place of 600-grit, and then I polish with 1,000-grit. Leading edges, wing tips and tail feathers stick out like sore thumbs unless they're really smooth, because the covering is stretched tautly and sealed to these areas.

## VACUUM BETWEEN SANDING

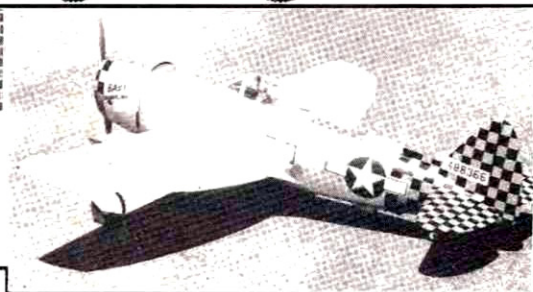
Vacuuming the model thoroughly between each sanding will ensure that you see imperfections. If you sand with your right-hand, use your left hand to feel the surface for irregularities, and vice versa. The hand that does less work has the more sensitive touch.

(Continued on page 106)

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# ABOUT THOSE ENGINES

JOE WAGNER



## NEW HORIZONS & OLD FAVORITES

AS OF THIS installment, I've been writing "About Those Engines" for eight years. Now it seems to be time to bring the series to its conclusion and start new ventures within these pages.

In the past 47 columns, I've discussed nearly every type of 2-stroke, CO<sub>2</sub> and compressed-air engine. I've written about old-time powerplants and the newest things on the market. I've discussed operation, maintenance, repair, customizing, lubricants, cleaning, restoration—and many other topics that you've brought to my at-

tention. In preparing all this material, I've learned a great deal myself, and I hope I've succeeded in passing along some useful and interesting information to you.

I want to tell you about my philosophy regarding model engines. I've never had much interest in the extremely high-performance types. To me, the truly important characteristics of model engines are reliability, long life and the fun that they offer. I prefer to use friendly, cooperative powerplants when I fly, which I do purely for enjoyment, never in pursuit of trophies

or records. Since I began messing with model engines in 1937, I've owned more than 1,000 of them. Some were absolute clunkers. A few proved to be highly temperamental. But most of them turned out to be reasonably satisfactory.

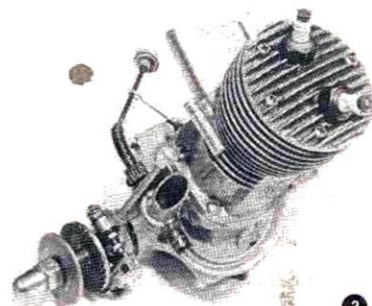
Of all these many types, makes and sizes of model engine, 10 stand out as my all-time favorites. If I had no other engines but these, I'd be satisfied to fly with them for the rest of my life. Here's a brief description and a picture of each.



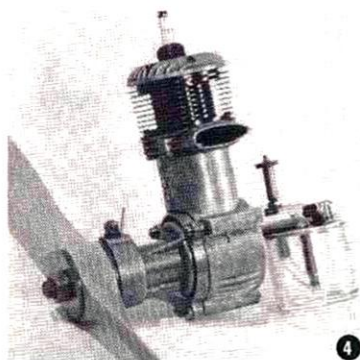
1 **1937 Brown .60 Model B.** This early spark was my first miniature engine. Although it had been well-used when I got it, it still runs great. This is the lapped-piston \$21 Brown. Later, cheaper versions weren't nearly as reliable or long-lived.



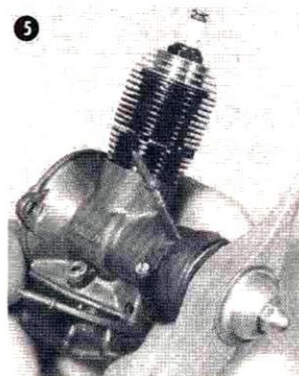
2 **1941 Ohlsson .23.** This is the engine that made flying "gas models" popular. More of these little gems were manufactured than all other Class B motors combined, until the advent of glow engines. During the '40s, 99 percent of the Class B model kits made in America showed an Ohlsson .23 on their plans.



3 **1941 Super Cyclone .647.** It was available with either a single or double spark-plug head. Twin plugs added power and eased starting—but required a double-size ignition coil. Many fliers admired the potent look of the twin-plug version. I was one of them; that's why I bought it.



4 **1946 Arden .099.** This revolutionary engine hit the postwar model market like a bombshell and started a whole new trend in engine design. In early '48, Ray Arden introduced the glow plug in this motor. (But I prefer to run my Ardens on spark ignition.)

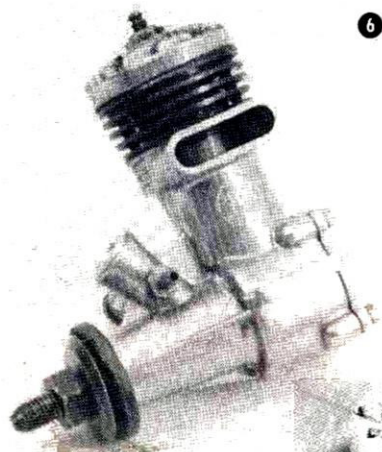


5 **1942 Forster .29.** Not only was it the most powerful model engine of its size in the early '40s, but it was also easy to start and not temperamental. I flew these often in free-flight and U-Control as late as 1951.

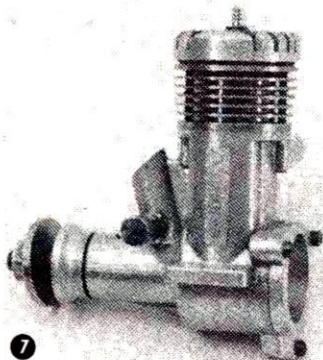
PHOTOS BY JOE WAGNER



## ABOUT THOSE ENGINES

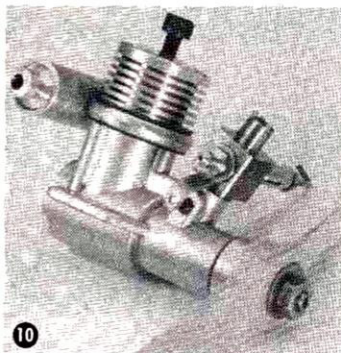
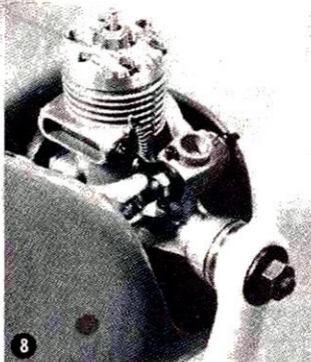


6 ◀ 1951 Torpedo .19. Johnny Brodbeck Sr. (the "B" in K&B) called this his "miracle motor." It may look like a typical lapped-piston, plain-bearing, front rotary model engine, but the .19 took the '51 Nationals by storm, winning ALL the Class A events—even U-Control speed! It's easy to hand-start, and has no evil characteristics.

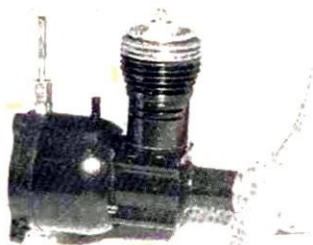


7 ▶ 1956 Johnson .29. There were several good control-line "stunt" engines in the '50s—the Fox .35, K&B .29, Veco TCC .31—but this is my favorite. Developed from the earlier Orwick engines, the Johnsons were friendlier, yet even more powerful.

▶ Lee Custom .19. It's my favorite R/C motor, though it's about 20 years old. My friend Clarence Lee developed this from his 1956 Veco .19 design, and he hand-fitted every part in each engine he sold. The throttle response of this engine is the most linear I've ever seen!



▶ .09 Twin Ball Race. I also like all the P.A.W. diesels, but my favorite is the TBR. It will spin anything I put on its shaft, from a 10x4 prop to a ducted-fan impeller; it's easy to start with either, and with everything in between.



9 ◀ Black Widow .049. I like all the Cox reed-valve engines! (I'm the guy who introduced Roy Cox to the reed-valve induction system.) Of the lot, this one is my favorite—especially this optimized version sold by Kustom Kraftsmanship.

I have just one more "Q&A Department" item. A question that many readers have asked me is: "Where can I obtain another \_\_\_ engine? I owned one as a teenager and had a lot of fun flying with it, but I gave up modeling while I was working and raising a family. Now that I'm retired, I want to get back into the game again—and find another good old \_\_\_ to do it with."

Sometimes I've been able to help readers locate what they're looking for; some-

times not. But now there's a brand-new publication out called "Engine Locator." It lists every kind of model engine, from antiques to the latest, new-in-the-box R/C types—including the engines that I've mentioned in this issue's column. They're all for sale from private owners, not dealers. The engines' descriptions, prices and source addresses are given, so you negotiate directly with the engines' owners—no "middleman" involved.

The current issue of "Engine Locator"

contains 456 listings of engines priced from \$20 (for a Gilbert .074) to \$3,500 (for a 1942 Elf 4). The engines are arranged in alphabetical order to make finding what you want as easy as ABC. Most of the prices seem quite reasonable, too. A one-year subscription to this bimonthly publication is \$25; contact Gerard Enterprises Inc., P. O. Box 229, Elm Grove, Wisconsin 53122; (414) 521-8547.



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 Weight ..... 35 oz.  
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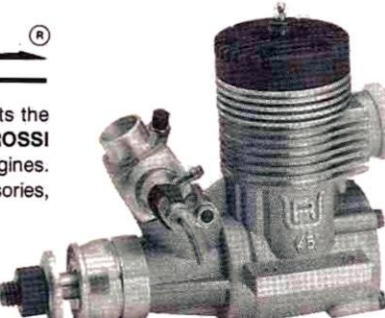
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## COVERING

(Continued from page 100)

With the last sanding (polishing) completed, it's time for another thorough vacuuming. Be particularly attentive to hinge slots and any openings to the inside of the fuse and wings. The inside of the fuse and wings should also be vacuumed.

### TACK CLOTH

The final touch is a complete wipe-down, inside and out, with a good tack cloth. A second wipe-down will catch the dust that the tack cloth disturbed but didn't pick up. This should be done as far away from your shop as possible, and these parts shouldn't be returned to the shop until they've been completely covered. No matter how clean your shop is, there will be something that can get under the covering. When your model has been covered and sealed, it's back to the shop for final assembly.

Learning to cover with film-covering materials can be broken down into seven steps:

1. You swear at the covering.
2. You swear at the iron.
3. You swear at yourself.
4. You talk to the covering and the iron.
5. You talk to yourself.
6. You begin to answer yourself.
7. Some kind of magic takes over. Even what seemed impossible is now working, and the only talking going on is all those other guys admiring your work.

In the next installment, I'll answer questions that will prepare you to jump directly to Step 7.

*\*Here are the addresses of the companies mentioned in this article:*

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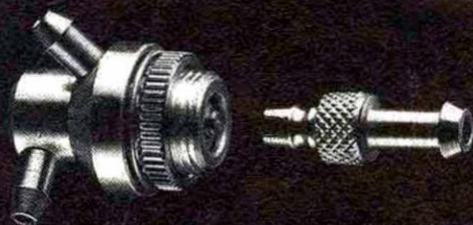
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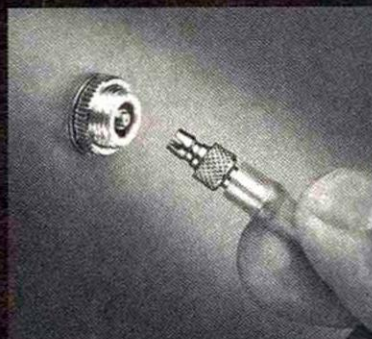
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# GOLDEN AGE OF R/C

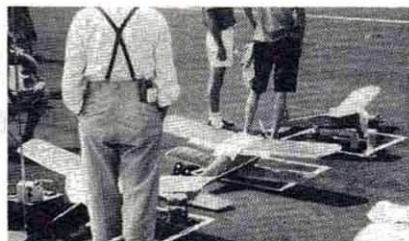
HAL DeBOLT



## ONE MAN'S MEMORIES

**LET'S START THIS** time with a photo-gravure. It isn't often that we get a set of photos covering an old-time event that will give you an idea of how it was in that day. The photos were contributed by Don Huff of Sunnyvale, CA, and thanks to his uncanny memory, he has also provided us with pertinent descriptions. Also included are some shots of his early activity while he was in the USAF in the '50s and '60s. Let's do this "by the numbers" so the descriptions can be more complete.

Normally, I tend to restrict photos so that there's more room for discussion, but this time, the priority was switched. Which format do you prefer?—more photos with less talk, or the usual way with more text. Please let me know. Remember, this is your OT R/C place!



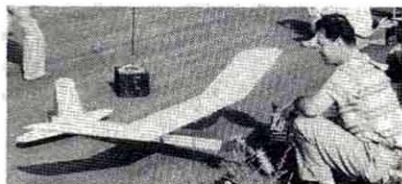
Taken in Philly in '57, this photo shows the R/C flight line that was typical of the early Navy Nats. If you think waiting to fly is terrible today, you wouldn't have liked it at all back then. There were two flying areas (if you were lucky)—one for the few on "ham bands" and the other for 27MHz.

With more than 100 entries, you'd only get one flight a day. At this Willow Grove event, a downpour had turned the flying area into a quagmire, which added to the flight-time problem. This meet was dominated by Rudder Bugs, Smog Hogs and Live Wire Cruisers and, as usual, I was the only one with a two-winger.

Don Huff tells us that the legs by the first plane in line belong to Willie Williams and Jerry Nelson. Note that the plane was a reed-equipped original design and probably Jerry's multi-channel entry. We're all familiar with Jerry, but some may recall that Willie was a perennial single-channel contender from the L.A. Larks Club. The Rudder Bug in the line appears to have used a two-tone, pulse-wave propo system. The other is obviously my custom biplane.



This is an excellent shot (taken in '57) of Walt Good's original Multi-Bug. He had made some subtle changes to the Bug's design when he switched from single channel to TTPW (two-tone pulse wave). Walt had been using the Multi-Bug steadily for several years, which was unusual for most fliers in that day! Note the large transmitter box used with his TTPW system and the separate control box. It even appears that Walt was still using a dipole antenna, which had to be set up and oriented for each flight. The year 1957 was still a transitional one for R/C. How many of you recall the six dry cells that sat on top of the transmitter and were used to light the glow plug? Walt's Multi-Bug now resides in the AMA museum.



Here's an example of Chet Lanzo's versatility as a modeler. For the '57 event Chet thought it would be nice to celebrate the 20th anniversary by letting us see how it was 20 years earlier, so he built and demonstrated this replica of his '37 winner. Does that make him "Mr. Vintage R/C"?



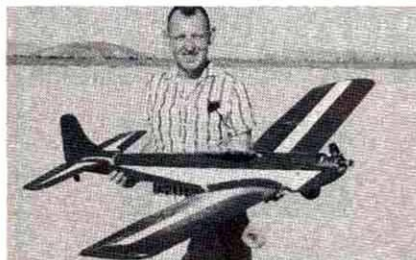
This is Larry Beason at Dover AFB in 1955. The Live Wire trainer that he's preparing for flight was powered by a Torpedo 15 and used a Lorenz Carrier Wave receiver—a common combo for single-channel flying during that time.



We generally associate Ernie Kratzet with Bramco and his Eskimo biplane. At this Nats, he flew a design inspired by Tom McCoy called the "Blue Razor." Tom had admired the performance of my Over & Under, but he was also addicted to larger models, owing to his success with a Schneider Cub. So, he took the basic Live Wire Champ design and enlarged it to suit his fancy. He added a symmetrical airfoil à la the Over & Under and produced a fine-performing multi for the time. There's no record of how Ernie did with it at the meet.



Now on to some of Don Huff's OT R/Cs of interest. This one is Don's version of the Crusader—deBolt's first low-wing design, built and flown in Hawaii in the early '60s. Don powered his with a K&B .45 and used Orbit reeds for guidance. He notes that, in competitions, it was the only design that would do clean vertical 8's—probably because of its lighter weight. Actually, when the Crusader was designed, my mind was still on the high wings and biplanes where lightness was essential. So, stringers were substituted for sheeting, and minimum structure was essential. Experience with the Crusader led to the first Live Wire low-wing kit—the Pursuit—which was completely different.



Here's Don in the early '60s stationed at Travis AFB, CA. The model is a highly modified Astro Hog powered by a Torpedo .45 and guided by an Orbit.





This is Keith Story's version of the Wittman Bonzo racer for the AMA pylon event. In this early racing event, the rules regulated the model size and engine displacement, with a maximum size of .19. Keith chose to go with the Oliver Tigre .15 diesel. In those days, the Tigre was the hot engine for control-line team racing and free flight. Unlike today's Formula 1, the first pylon event was flown one plane at a time against the clock. It took the 72MHz band to get enough frequencies for multiple-plane racing. Again, Don tells us the Blue Mambo in the photo was Willie Williams' entry in single channel.



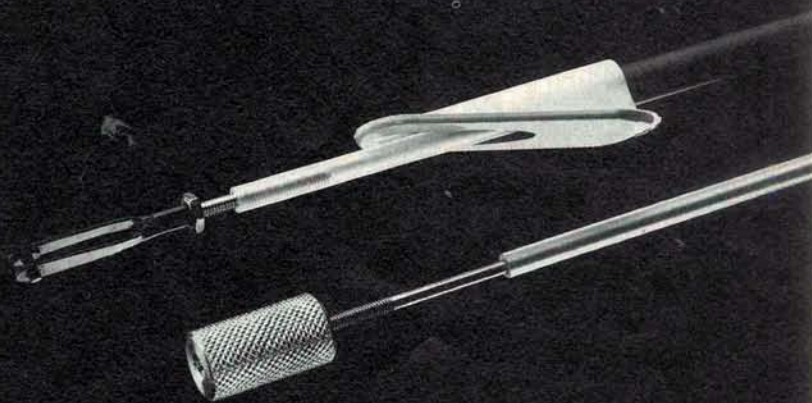
PHOTOS BY DON HUFF

Here's another model by Don Huff; this photo was taken in Waco, TX, in '58. These Air Force guys sure do move around! Don had admired my smaller version of the custom biplane, and he believed that it was based on the Live Wire Rebel design, which was a good guess. So, he took a Rebel, added a lower wing and switched to symmetrical airfoils. His version was powered by a Fox .25 and controlled by a C-S 8-channel, which ultimately failed and led to the demise of his pretty model. Note the lack of a cowl over the engine and the brass Dmeco positive-flow fuel tank. The man in the photo was a fellow student in radar training, which was required if you were going to sit in the rear seat of a full-scale F-89.

(Continued on page 110)

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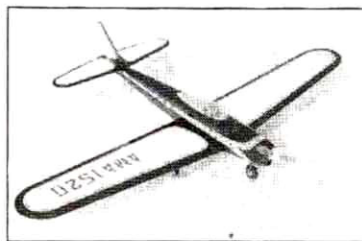


## DESIGNS FOR THE SPA



At the '65 Philly Nats, this Mk V Interceptor came within five points of a perfect score.

The advent of the Senior Pattern Association opens the door to a multitude of interesting OT R/C designs, many of which will perform well, even by today's standards. Let's look at some that might whet your appetite.



This Mk I Interceptor was powered by a Merco .49. It had a Space Control radio and retracts.

It seems prudent to start with the design that set the pace for modern pattern winners. Close inspection of this 1964 beauty will reveal all the features that are still pertinent.

The Interceptor was featured in the January '64 issue of *Model Airplane News* and in the January '66 *American Modeler*. Specifications: wing-span—68 inches; wing area—750 square inches; engine—usually a Merco .49 or .60; weight—6 pounds, including an 18-ounce radio and 12-ounce retractable gear, when it was used. (For simplicity, the Mk V described in *American Modeler* had a fixed gear.)

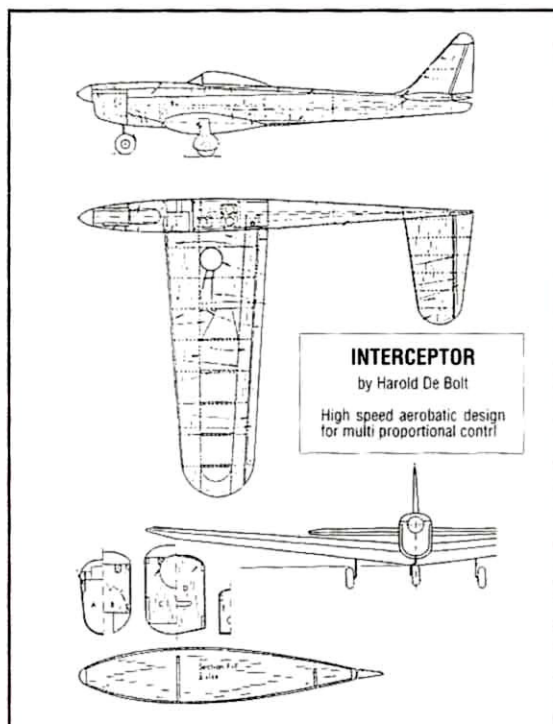
As far as I'm concerned, the Interceptor represented

the pinnacle of pattern design. Previously, most new designs had simply evolved from what had been before. With the Interceptor, the aim was to apply the principles of aerodynamics in every respect—no holds barred; no effort too great. Considerable research resulted a model with outstanding performance that was a true joy to fly.

When designing it, careful attention was paid to drag, and it would be hard to find a "cleaner" airplane. The heart of any design is the wing, so much care was given to that. The classic planform equalized span loadings, while the

NACA 6500 Series airfoils yielded the required lift and stability with minimum drag. Progressive airfoils were used for the first time. Speaking of airfoils, note that the search for maximum efficiency even included the use of the 6500 Series for the tail surfaces. As the Series developed, designers found a force arrangement that provided the ideal lift proportion between the wing and tail. As a result, no trim changes were required as the Interceptor's speed or attitude changed.

Perhaps it would take a little extra effort to make this model, but built as it was originally, it would be outstanding on any flight line, and the joy of flying it would be ample payment.



Interceptor three-view. With this plane, the principles of aerodynamics were applied in every respect.



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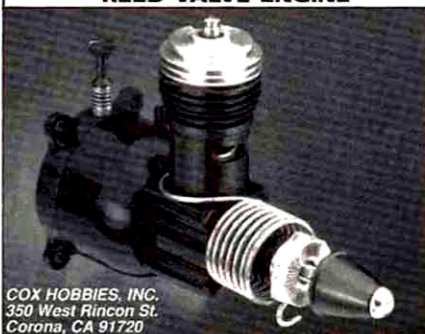
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## AIRWAVES

(Continued from page 10)

### HOW MANY G's?

As an engineer, I greatly appreciate the articles by Andy Lennon. His rational approach to design is certainly preferable to some of the unsubstantiated rules of thumb that crop up from time to time. However, I believe his dissertation on wing-loading design (August '92) is a bit shaky.

The text gives the unfortunate (and probably unintended) impression that Andy's formula for load factor is applicable to maneuvers in the horizontal plane, i.e., turns. In fact it can't be, since it depends on G, which acts vertically. Instead the formula is valid for vertical pull-outs from dives, loops, stalls, etc., which, in any event, can impose more severe loadings than turns.

But my quibble is that Andy and others (like me) usually underestimate the dimensions and duration of maneuvers and overestimate speeds, so that the tendency is to make unrealistic assumptions as to what a model's capability is, or should be. This of course leads to excessive design loadings, overdesign and excess weight, all to the detriment of flight characteristics. For example, Andy's illustration of a pull-out on a radius of 50 feet at 90mph means that the maneuver would have to be executed in a little over 1/2 second. I question whether this is even possible, let alone necessary, considering such factors as the pilot's thumb movement, the response time of the servo and its linkages and, not least, the authority (effectiveness) of the elevator.

So if the maneuver can't be executed that quickly, what happens? The model simply responds to the command as best it can and, in so doing, takes its own time and determines its own pull-out radius, the pilot and designer having had only indirect influence. If, in Andy's example, the maneuver had taken 1 1/2 seconds, the radius would have been 115 feet and the load factor 5.7G, which is less than what Andy computed.

Fortunately, load factors can be calculated, but you must realistically evaluate what the model is intended to do—in other words, a process not unlike that applied to full-scale aircraft. Methods for estimating (and controlling) load factors are too lengthy to describe here, but some interesting values generated by pull-out maneuvers are:

- Immediate recovery from a stall—3G
- Perfect loop, model just making it over the top—6G (this applies regardless of the radius of the loop)
- Initial speed 100mph, execution in 1 second, exit speed, 117mph—9.5G

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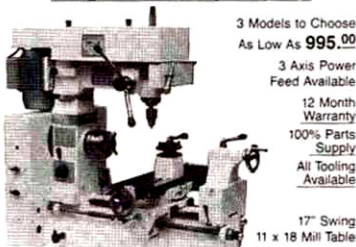


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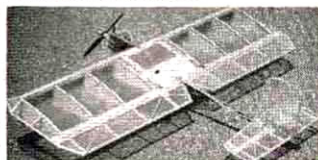


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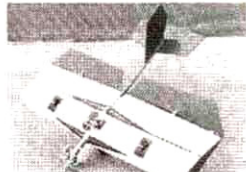
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## AIRWAVES

All of which suggests that, for the average sport flier, 7 to 8G should be plenty. Hot-doggers should probably go to 10G.

J.C. STEVENS

White Rock, British Columbia, Canada

Mr. Stevens, the article you refer to contained relatively little discussion of centrifugal force. The intent was to show the high maximum loads resulting from sharp maneuvers, which is, after all, what the designer must contend with.

I'm well aware that horizontal maneuvers generate less centrifugal loading and that the higher drag of the higher angle of attack would reduce the model's speed.

Your comments on the time for executing a 90-degree pull-out of 50-foot radius at 90mph are interesting. Futaba quotes a servo-operating speed of 0.22 second for 60 degrees. The Swift's elevators have a travel of 25 degrees—so that the full elevator action would take 1/10 second. The finger action, servo response and start of the maneuver would all coincide. Elevator area is 40 percent of the total horizontal tail area, so they are very effective.

A turn of 50-foot radius is part of a circle of 100-foot diameter. The Swift performs vertical 8s with ease; the loop diameters do not exceed 100 feet. Your estimate of 1/2 second is correct for a 90-degree turn.

Thank you for taking the time and effort to write. Your interest is appreciated. AGL



### A-10 SWITCH

I live in New York City, and for months I toyed with the idea of building an R/C America's Cup sailboat—that is, until I met some of the

(Continued on page 116)

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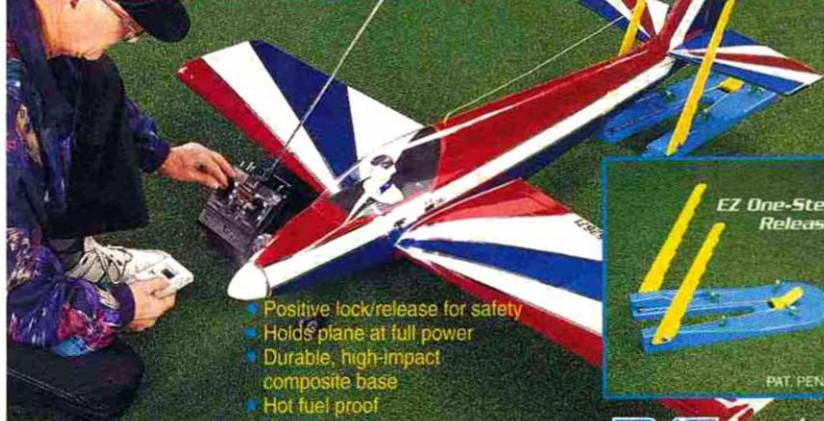
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## AIRWAVES

(Continued from page 115)

people at the local model boat club (I've met friendlier folks in taxi crashes).

Then I ran across John Kidd's great article on building an A-10—"1/2A Sport-Scale Tank Buster" (August '92), and it got me thinking. I've always been a "fringe" observer of R/C and have never built a plane from scratch, nor does my lifestyle permit me much time or workshop space. Also, being stuck in the middle of Manhattan doesn't make for easy nearby flying.

Although touted as an "easy build," it still seems like a daunting task for a novice equipped with little more than an X-Acto no. 11 knife, a ruler and a Dremel. Tell me when the kit comes out—any manufacturers out there listening? Retracts and throttle controls would be nice.

In the plans, the author uses cut-down props to simulate a ducted-fan engine. Thinking as an inexperienced builder and flier—and not knowing the operational rpm or torque of a Cox TD .051 or .09 (optional), how practical would it be to salvage and adapt the blade wheel from a couple of 4- or 5-inch electric muffin fans? These fans come in a variety of CFM ratings and are made of materials that range from plastic to fiberglass composites to aluminum. The blades usually number from 5, 6, even 7, and are built for high flow rates and low noise, in a cowl.

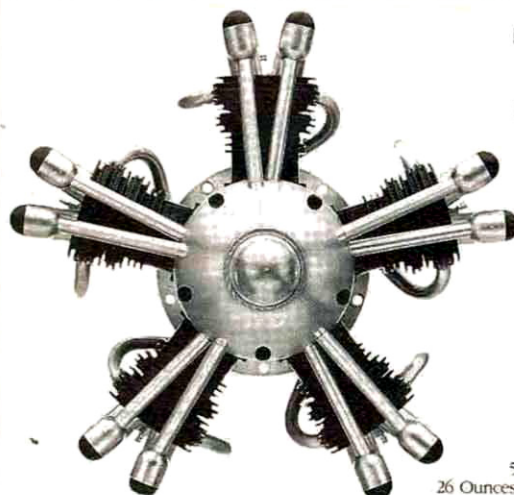
Also, because these fans typically have large hubs, a prop spinner can be easily added to further enhance air flow and give a more realistic turbo-fan engine appearance.

In the words of the locals: so whadyathink?

DANIEL WONG  
New York, NY

*Daniel, please don't judge an entire segment of a hobby by the actions of a few individuals in one group or club. If you'd still like more information about model boating, check out our sister publication, Radio Control Boat Modeler. It contains lots of information about clubs throughout the New York/New England area, and most modelers in these clubs have positive attitudes.*

*As far as the "easy-build" A-10 goes, it is easy to fly, and it isn't all that hard to build, but it wasn't designed to be a trainer. It isn't our first recommendation for a novice, although many would succeed with it. We've received a press release from Imagination Aviation that lists a kit for \$149.95, complete with fuel tank and jet ducts. For more information, contact the company at P.O. Box 1121, Mandeville, LA 70470; (504) 626-5433.*



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## AIRWAVES

Don't use anything other than aircraft model propellers with the engines. Muffin fans may look like real impellers, but they could cause serious injury if mounted on a model engine. They're not designed to turn at the high rpm of a Cox T.D. engine. Ducted-fan design is a science, not based on what seems to look good!

I'm sure you could install the retracts and throttle servos, but this would increase the expense and would increase the weight and wing loading. Half the fun of modeling is experimenting, so why not give it a try and let us know how it goes?

GY

## MOVIE START-UP

Recently, I saw a movie entitled "Toy Soldiers," in which a model airplane was used in a number of shots. To start the engine, the actor just flipped a switch on his transmitter. How in the world did they accomplish this? I doubt that they used special effects, because the engine turned the prop and started without using a starter cone. I was hoping that your staff might have some ideas or that the readers of *Model Airplane News* might have a suggestion. If a starting system like this is possible, I'm sure that many other modelers, including me, would love to have one on their plane. I'd like to congratulate your company on an excellent magazine. I love the coverage of everything from 1/2A to giant scale. Keep up the good work.

CHRIS FILTZ  
Schofield, WI

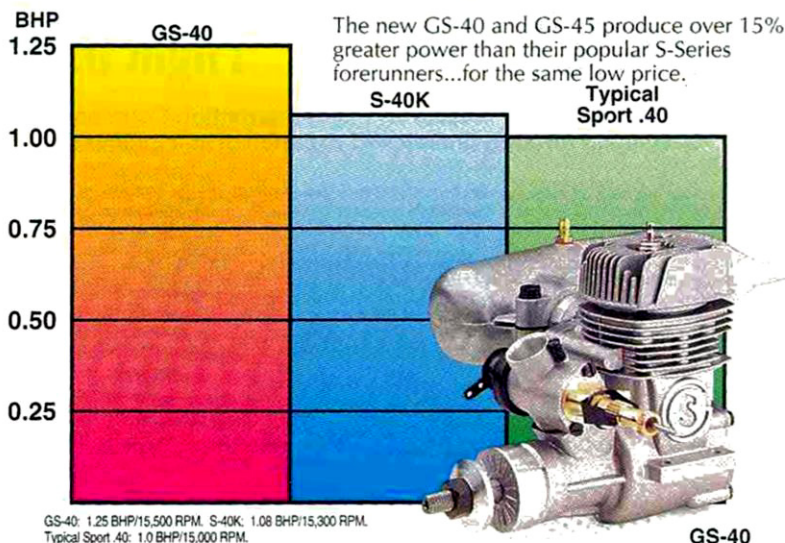
Chris, with all the computer-controlled special effects, it seems as if anything is possible in the movies these days. You're correct that the auto-start model airplane wasn't a new brand of trick photography. Hobby Lobby makes an on-board starter called "FEMA" for model airplanes. It consists of an electric motor, a gearbox, a drive shaft with universals and a gear adapter, which is mounted on the prop shaft. A microswitch, a Ni-Cd battery and a glow-plug driver complete the system, and it can be switched on by your radio. The FEMA system is available for most engines from .40ci to large gasoline engines, such as the Zenoah G-62. For more information, contact Hobby Lobby, 5614 Franklin Pike Cir., Brentwood, TN 37027.

GY

## TO BE CONTINUED

I've enjoyed the articles in your magazine for some time and look forward to each issue. The June '92 issue didn't do a good job of keeping

(Continued on page 118)



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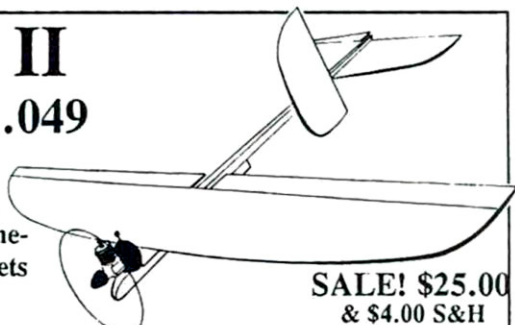
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## AIRWAVES

(Continued from page 117)

my interest because of all the continuations. The "Airwaves" column starts on page 8 and flows over to page 9. That's to be expected; turning the page to 10 is also expected. At this point, the column skips to page 75 for only about 2 inches, then skips to page 86 for another 2 inches, then to page 116 for 8 inches, page 117 for 5 inches and then jumps to page 119 for 7 inches, page 120 for one column and concludes on page 121.

If you bounced a plane that many times on landing, you'd be considered a very poor pilot. I'm also aware that advertising pays for the magazine and that columns have to be continued to fit in with the ads. All I ask is that you take into consideration the readers for whom you labor so hard and make it more enjoyable for us to read your columns. I won't compare your magazine with others in the industry. You've been in business for many, many years and provide us with the finest information. Again, I only ask that you put it together in a more readable form. Yours for modeling....

EDWARD H. PLOURDE  
Tampa, FL

It's true that we run many articles into what we call "back of book." We have to carefully blend the articles and advertising so that everything fits between two covers; but we do try to run as many articles as possible "flat"—no jumps. We also try to keep these jumps to a minimum, but it's just unavoidable, and we choose to "jump" the letters rather than the articles because there are more natural breaks. You're right, advertising pays for the magazine and help keeps down its price for you. Looked at that way, it isn't too bad, is it? Thanks for your comments—and for not sending your letter on several sheets of paper—each containing a few lines of type—with a "continued on" at the bottom of each sheet. (One reader recently did this to illustrate your point.) GY

## CROSSWIND COURSE

Dave Patrick really does know how to take off in crosswinds, and a lot of R/Cers don't have a clue, so I was glad to see his article on that subject. Unfortunately, the article itself was confusing, partly because the drawings and text didn't match. The essence of the article boils down to two things:

- When taking off in a crosswind, use the ailerons only to keep the wings level, not to steer the airplane.
- Steer a straight course with the rudder stick, both on the ground and when the plane is airborne. Just do whatever you have to do with

(Continued on page 122)

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Ed Couch's F-33 Fury

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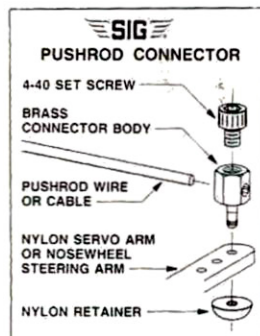


## WINDSOR PROPELLER Classic Series Propellers

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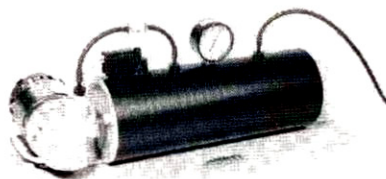


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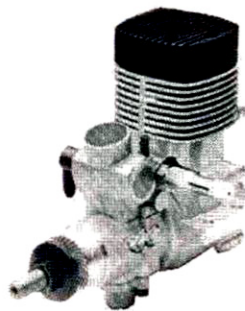


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## FUTABA YS. 61AR Long-Stroke Engine

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Part no. YS0091

Futaba Corp. of America, 4 Studebaker, Irvine, CA 92718.



# PRODUCT NEWS

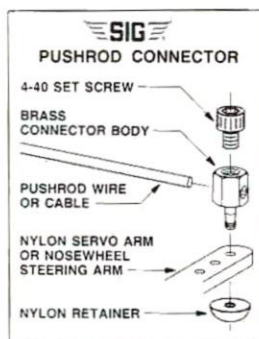


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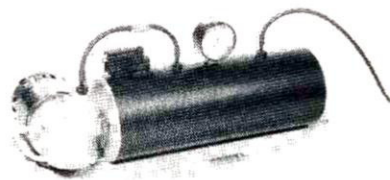


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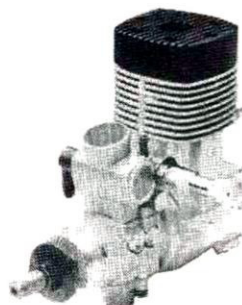


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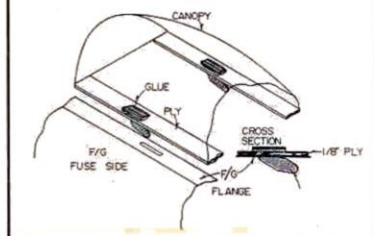
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# PRODUCT NEWS

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Bob Violet Models Inc., 1373 Citrus Rd., Winter Springs, FL 32708; (800) 899-1144.

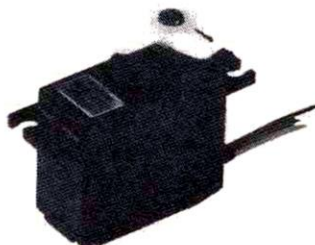


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Part no. JRPS4131

Price: \$84.99

Hobby Dynamics Distributors, 4105 Fieldstone Rd., Champaign, IL 61820.



### VAILLY AVIATION Hawker Sea Fury

The Hawker Sea Fury is scaled at 2.35 inches to the foot. Plans and parts are available separately, or as a package. The plans show all the structures drawn full size including the flaps and retracts. Full-size templates are also shown for all the ribs and formers. Parts available: fiberglass cowl, clear plastic canopy, aluminum spinner and backplate. All structures are built up and sheeted with 1/8- or 3/32-inch balsa. No foam is used. A partial wooden kit is also available. Specifications: wingspan—90 inches; length—81 inches; engine—3.7 to 4.2 cubic inches; wing area—1,800 square inches; weight—28 to 35 pounds.

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by JEFF RASKIN



## R/C AIRBORNE VIDEO: THE HELIS

**Subject:** Photography and video taken from R/C helicopters

**Source:** R/C World Video, 1403 Bayview Dr., Hermosa Beach, CA 90254

**Summary:** Informative, fun, inspiring.

**List price:** \$24.95

**Length:** 60 minutes

The model helicopter, like its full-size counterpart, can be operated out of locations that would be difficult for fixed-wing aircraft of any size. The skill of the pilots in putting their craft where they want them is impressive, and some of the footage in this video is amazing. The production qualities are average, with only a few careless edits. There is a jumble of unedited, but interesting, tape after the formal ending.

The builders and operators of these models have shown a great deal of cleverness, mechanical and electronic engineering competence, and persistence. This video is a tribute to them, and an inspiration to the rest of us.

A couple of blokes from New Zealand have mastered operating still and video cameras from model planes. Their story is the first segment in this friendly, understated potpourri from Down Under. It's distributed by Supercircuits, which makes small, "flyable" electronic kits for transmitting video from planes to the ground. They deserve considerable credit for not making the video into a mere advertisement; I mention their name here in honor of their not doing so in the video.

The main section on airborne cameras (both still and video) and transmitting video to the ground in order to aim the cameras in the air delivers the goods. An expert modeler could proceed without further information. But after this great start the video cuts to a section on engine-powered gliders, which includes what some would argue are unsafe practices, such as reaching across the propeller to adjust the engine, and hand-catching.

Ho and hum are replaced by ooh and aah as we are next taken on a dazzling 8km goal-and-return beachfront sailplane flight. The intrepid pilot follows the sailplane on foot, scrambling

The opening sequence tells the whole story: we chase an R/C car from a few feet above it, explore a marsh and follow a bird flushed from a field. We see the world from an eye that moves with dreamlike freedom. How about making your models pay for themselves by shooting real estate photos from angles the agents can't get to, helping rescue operations, doing engineering studies, taking air-to-air films of other models and making aerial views for surveyors? You can do it with a model plane, or, as this video shows us, even better with an R/C helicopter: an eye on a hook in the sky.

The main technical problem is vibration, but solutions—in the form of practical advice from people who have made it work—are shown. One surprising discovery, logical in retrospect, was the utility of having two operators: one flying the model and the other pointing and operating the camera system remotely, watching through a downlink. The signal received at the ground, while good enough for aiming the system, is of relatively low quality. Therefore, to get high-quality pictures, both still cameras and "hand-held"-size video recorders are used on board the helicopters.

## R/C AIRBORNE VIDEO II

**Subject:** Movies and videos from model planes, goal and return sailplane flight, scale FE2  
**Source:** R/C World Video, 1403 Bayview Dr., Hermosa Beach, CA 90254; (213) 372-9166.

**Summary:** Very watchable, lots of good information, dramatic.

**List price:** \$23.95

**Length:** 60 minutes

(Continued on page 138)

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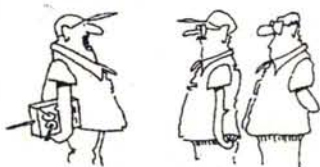
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# CLUB OF THE MONTH



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On the front page of the club's newsletter—"Just Plane Talk"—the headline reads: "He did it! Hard work and dedication pays off for club member." "He" is Francis Wesley, who soloed his trainer and flew for about 10 minutes before making a successful landing. Way to go, Francis!

Club president Don Zais writes about the club's involvement with a local E.A.A. chapter during an Airport Days event and about how the club participated in the 4-H Summer Youth Activities last summer. Several kids put in some stick time, and some of the fathers even gave it a try. With rising insurance premiums and dwindling flying fields, a club that interacts with the community and encourages kids to get involved is to be commended.

Russell Knetzger's article—"R/C Model Aerobatics for Sport Fliers"—describes pattern and aerobatic maneuvers, and it includes a list of instructors to make it easier for beginners to solo.

"Just Plane Talk" has a lot of "plane" truth in it. Keep up the good work, and enjoy your two, free, one-year subscriptions.

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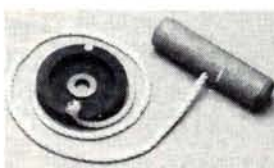
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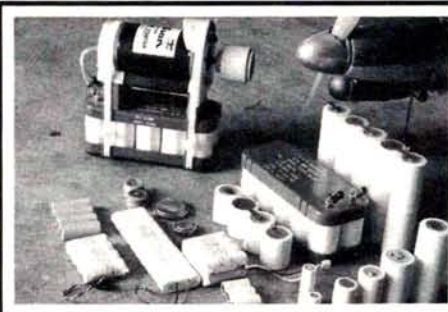


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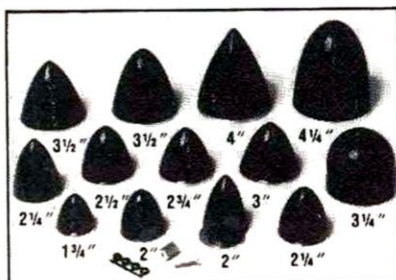
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## AIRWAVES

(Continued from page 122)

### THE COST OF MODELING, THEN AND NOW

After a long absence from the hobby, I've recently retired and re-entered the hobby. I relied on *Model Airplane News* back in the early '30s when I first started building, and I thought, what better way to renew my acquaintance with the hobby than by subscribing to your magazine?

To say that the hobby has changed a lot would be an understatement—it's practically unrecognizable! I'm completely appalled by the cost of participating in the hobby today.

I was brought in by my father, who built bamboo-and-silk A-frame models and progressed to various rubber-powered types, all of which fascinated my young mind. I, too, began with simple slab-sided rubber jobs, leading to some fairly ambitious and sophisticated Wakefield models—one of which, built from *Model Airplane News* plans, rewarded me with a flight of over 30 minutes. I still have a faded photo of myself as a small boy proudly holding this model, somewhat larger than I was.

The point of all this is that, had the hobby been as expensive then as it is now, neither my father nor I would have been able to enjoy any part of it. When I peruse the ads in your magazine, I see plane kits costing up to \$1,000 dollars, engines that cost more than automobile engines and radio gear that's more expensive than a good stereo system. How do you expect to attract new blood into the field with costs like these?

If you truly want to bring youngsters into the hobby, let's have some plans of models suitable for their skills, and let's see some manufacturers produce items commensurate with the income level of a kid.

Forgive me for sounding off, but I needed to get that off my chest.

WALTER E. EMERY  
Eastport, ME

Mr. Emery, you may have missed the ads for inexpensive engines like the K&B .20 Sportster and Fox .40. How about the Goldberg Eagle II trainer, which is under \$50?

Now, I realize this is more expensive than bamboo-and-tissue modeling in the '30s, but modeling has evolved, and today's spectrum includes what was available then and a lot more. The point is, the hobby industry today is working even harder to produce low-cost products than they are to create high-cost products. The selection of hobby equipment has simply broadened to fit a greater variety of preferences and pocketbooks. We have published many features and how-to columns that have been directly for beginners on budgets, and we plan to publish even more. In a recent issue, we included a pull-out plan of a simple Randy Randolph 1/2A design called the "Bee-Tween." The plan was free!

CC

## LOOK OUT!!!!

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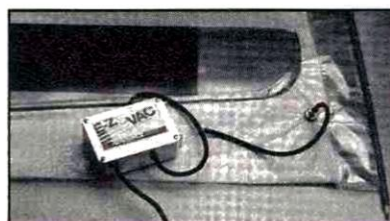
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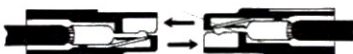
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## VIDEO VIEWS

(Continued from page 123)

over rough terrain, gleaming shreds of lift from dunes and walls not as tall as the pilot, sometimes scraping for lift a mere meter from the ground. The scenery ranges from very pretty to breathtaking and the film looks like it was made to order for the New Zealand Travel and Tourism Board. It's hard to see how a viewer could fail to be inspired to get a glider and try a similar flight. A minor technical inaccuracy occurs when they equate the lift from a moving water wave with dynamic soaring—no matter.

I thought that the tape would end here, but another enjoyable chapter on a scale WWI biplane, the FE2, followed. This segment is a fine way to present a scale subject in context, mixing shots of the model on the ground and in flight with old photos and memorabilia from the WWI. The narration was lively, interesting and informative. The tape could have ended here, but there's one more segment. Without explanation or introduction, we are watching from an on-board camera as a model plane does aerobatics. It's an interesting idea, but the action was not up to the production standards of the rest of the video. Believe me, the Airborne Video and the Goal and Return flight sections alone are worth the price of admission.

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